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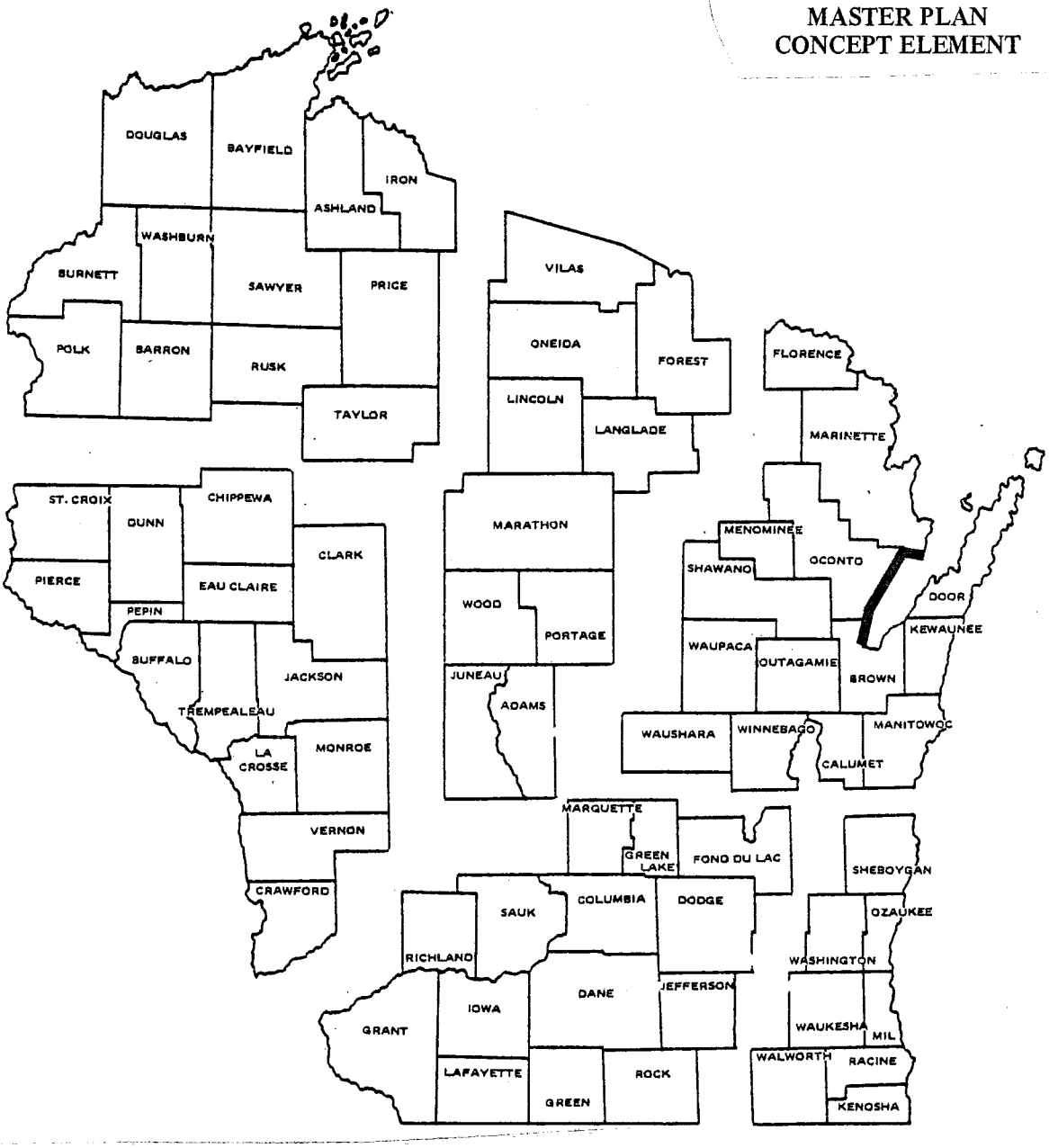
GREEN BAY WEST SHORES MASTER PLAN CONCEPT ELEMENT



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Date

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
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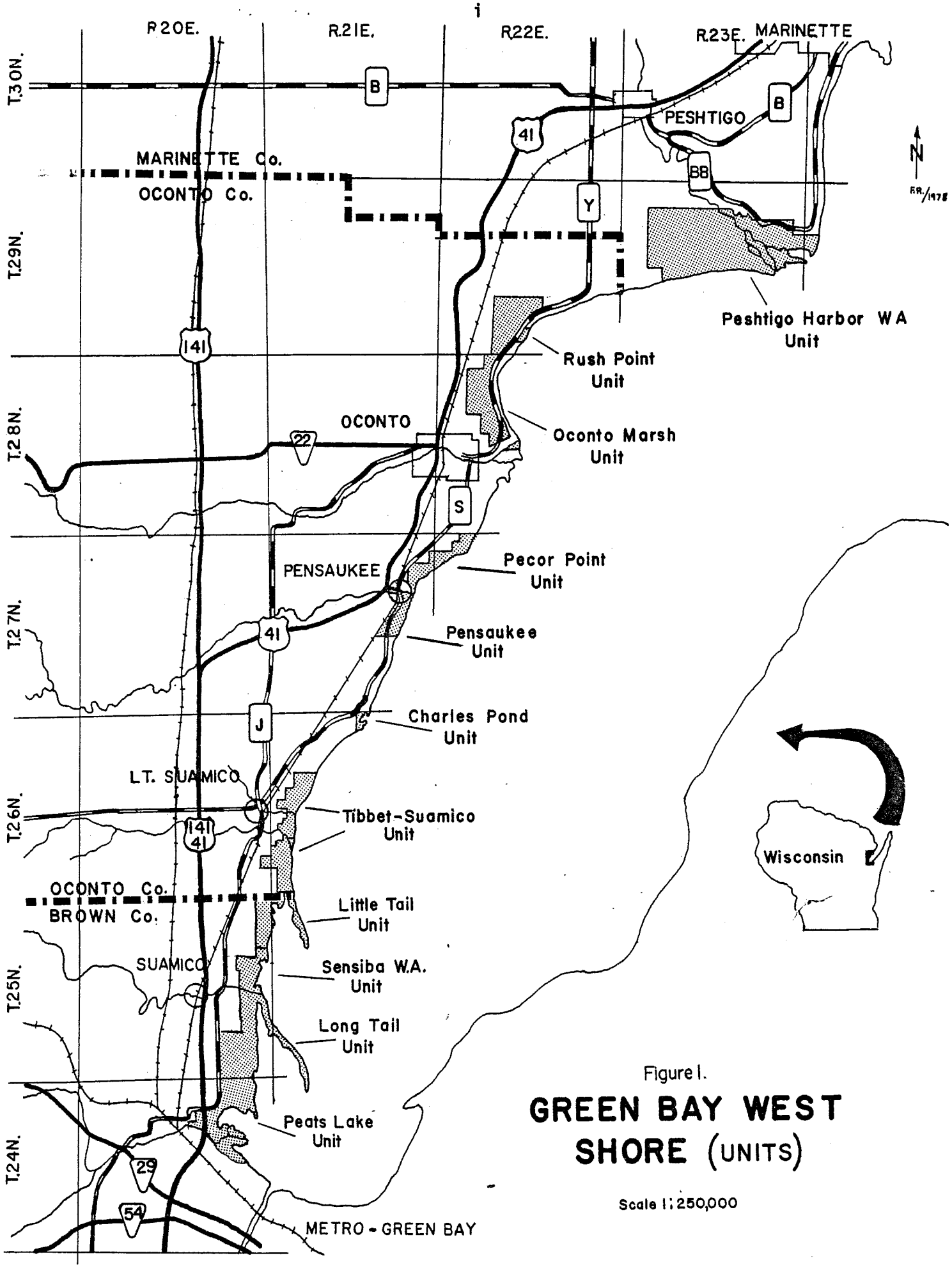

Figure 1.

GREEN BAY WEST SHORE (UNITS)

Scale 1:250,000

I. BACKGROUND INFORMATION

The Green Bay West Shore project is located on the west shore of Green Bay-Lake Michigan in Brown, Oconto and Marinette Counties of northeast Wisconsin (Figure 1). The project is a corridor extending for approximately 42 miles adjacent to Green Bay. The project begins just south of Duck Creek and extends north, through the Peshtigo Harbor Wildlife Area. Communities near the project are Green Bay, Howard, Suamico, Little Suamico, Pensaukee, Oconto, Peshtigo and Marinette.

The Green Bay region has a great natural wealth and a long history. Many changes have occurred in the Bay and its watershed over the last 300 years. The early French called Green Bay, Baye Verte, although they also referred to it as Baye des Pauns, which meant "stinking bay" (Ditton and Goodale, 1972). This may be more applicable today than it was in the 1630's when Nicolet canoed these waters. The French exclaimed on the richness of Bay Verte with its fish, fowl, furbearers, wild rice and concentrations of Indians along its banks. This had been from the earliest time a central area for both Siouxan and Algonkin Indian complexes. The ancient culture, "old copper", reached its fullest development along this shore and initiated a continuum of settlement and culture that remained unbroken until 1735. At this time, the French moved the Indians to a mission in what is now the City of Green Bay. In 1785 only about 50 settlers were in the area. The tide of foreign immigration began about 1848 and the 1880 census reported 11,795 inhabitants (U.S.D.A., 1974). The early settlers engaged in fur trading and limited farming to supply their own needs.

After 1840 the lumber industry expanded rapidly. The City of Green Bay never became a sawmill town like Oconto, Pensaukee, Peshtigo or Marinette but supplied many of their needed services. The immigrants also built cabins on the shore of Green Bay and began to fish the remote waters of Green Bay. The fishermen like the lumberjacks were a special breed with their activities revolving around the cycles of the Bay. The early settlers, no matter what their occupation, followed America's pioneering philosophy of resource exploitation and were ruthless in their harvesting of forests, land and fisheries, and in their harnessing of water resources.

The west shore of Green Bay at the turn of the century had a low distinct shoreline, turbulent water, marshes, wild rice, muskrats and waterfowl as it did 6000 years ago when the first Paleo-Indians moved into the region. Today, the wild rice is all but gone, as are many fish and waterfowl species once present in very large numbers. However, many furbearers, waterfowl and other plant and animal species of the Green Bay ecosystem remain. Remnants of the coastal wetlands remain and these are under a constant threat from residential encroachment, agricultural development and such associated changes as dredging, filling and shoreline protection. Protection of the remaining wetlands is paramount for today and the future, which is a significant objective of the Green Bay West Shore Master Plan.

In the early 1930's, consideration was finally given to the extensive marshes of Green Bay. At that time, the combination of deltas and long trailing sand bars that formed at the mouth of the Fox, Duck Creek, and Suamico Rivers still attracted waterfowl in numbers reminiscent of the great flocks of the past. The resultant pollution from the people and industry of the area became severe enough to warrant an investigation with recommendations for solving the situation. In 1936 the first federal waterfowl refuge for the Bay shore was established on 104 acres of Long Tail Point. The refuge was terminated in 1961 and the land turned over to the state and managed as a wildlife area.

State activity on the west shore began in 1948 with the acquisition of Sensiba Wildlife Area. In 1954 four miles of shoreline were purchased in Peshtigo Harbor. Subsequent projects were established at Pensaukee in 1956, Rush Point in 1962, Charles Pond in 1965 and Oconto Marsh in 1967 (see Appendix B). In 1965 it was recommended that all shoreline property on the west shore, except Brown County, be placed under one project, the Green Bay Shores. Coastal areas in Brown County were not included in a project and state acquisition was not pursued in the area. In the late 1960's and early 1970's, an interest in wildlife conservation and wetland protection developed. Many local conservation organizations and university groups proposed projects in Brown County which resulted in the West Shore Wildland Proposal of 1970 and the donation (by the Fort Howard Foundation) of Peters Marsh to Brown County. State acquisition in Brown County began in December, 1978, under the Bureau of Wildlife Management.

Presently, the state owns and manages 5,209 acres of land along the west shore. The majority of the land, (5,040 acres) was purchased by the Bureau of Wildlife Management and is managed as wildlife areas and remains open to hunting and water based recreational activities. Current management of wildlife areas on the west shore includes potholes for waterfowl in Pensaukee and in Rush Point, and two impoundments, one in Sensiba and one in Oconto Marsh. Both impoundments are excellent waterfowl production areas and are closed to hunting during the waterfowl season. State lands on the west shore which are not designated as a wildlife area are managed as a scientific or as fish management areas. Charles Pond is a 110 acre scientific area on the west shore (see Appendix B) and is managed accordingly to limit access, avoid development, and protect the area from human disturbance. The fish management area located in the Long Tail Unit is to be developed as an access to the Bay. Land in the Little Tail Unit is managed as a fish spawning and nursery area.

Current management policy on all state land on the west shore promotes public hunting and waterfowl production. Secondary aspects of providing trapping, fishing, and educational opportunities have been incorporated into the management strategies of the property. These uses of the state areas are measured in participant days obtained from car counts and personal observation, and will be used in the master plan.

One of the most important aspects of state ownership and management on the west shore has been the removal of the threat of residential and agricultural encroachment and irreversible and detrimental changes to some of the wetlands of the west shore. Wetland protection is an important part of the management of the shoreline.

Land within the West Shore Project was divided into 11 units to facilitate an easier identification and reference of parcels, developments, and management practices. These are illustrated in Figure 1 and Appendix B.

II. GOAL AND OBJECTIVES

Goal

Manage the Green Bay West Shore with the emphasis on wildlife protection, wildlife based recreation and habitat preservation; keying on migratory waterfowl and certain nongame birds. Management will be directed at maintaining the ecological integrity of the shore zone as a vital aspect of the total Green Bay ecosystem.

Objectives

1. Conserve, manage and enhance those parts of the littoral zone and adjacent uplands which provide habitat for breeding and migratory waterfowl; primarily mallard, blue-winged teal, gadwall, Canada goose, shoveler and black duck, producing three ducklings per acre of brood water (approximately 5,000 acres).

2. Protect and maintain one colony of cormorants, three colonies of black-crowned night herons, one colony of common terns, and two colonies of Forster's terns.

3. Provide 11,300 additional participant days of hunting and trapping per year (Currently 14,700): 20,000 for waterfowl, 2,000 for deer (1,500 gun, 500 bow), 2,000 for small game and 2,000 for trapping.

4. Protect a minimum of two sites along the bay for scientific study and educational purposes as well as a minimum of one historic site.

5. Provide annual recruitment of yellow perch, northern pike, walleye, and other species to the sport and commercial fisheries.

6. Provide a minimum of 45,000 angler days annually.

Additional Benefits:

1. Accommodate 30,000 participant days of compatible recreational activity including boating, swimming, hiking, skiing, nature observation and related uses.

2. Benefit nongame species including herring gulls, ring-billed gulls and birds of prey which utilize the bay shore.

3. Conduct forest management practices with harvest of available forest products when consistent with wildlife species management practices.

III. RESOURCE CAPABILITY

A. Geology, Soils, Hydrology

1. Geology

The geologic and geomorphic characteristics of the coastal zone and the natural processes have shaped and continue to have an effect on the complex environment of the coastal west shore of Green Bay. The west shore is entirely within the glaciated area of Wisconsin and an ancient lake system. The bedrock of this area is composed of the Platteville-Galena Group (Ordovician, dolomite and limestone) 200-300 feet thick (Hough, 1958). The bedrock substrate is not very erosion resistent thus influencing water quality and playing a major role in shaping drainage patterns.

The four glacial ages (Nebraskan, Kansan, Illinoian and Wisconsin) during the Pleistocene Era, scoured some lowlying areas and covered them with moderately thick deposits of unconsolidated glacial till. The glacial deposits smoothed the topography, which affected runoff and infiltration of the surface waters. This created a gradual sloping topography. Glacial deposits are also the parent material for most of the Green Bay west shore soils.

The past glacial history of Green Bay is one of advancing and retreating shorelines. Ten thousand years ago Lake Chicago, which occupied the present Lake Michigan Basin, was at 600 feet elevation, 20 feet above the present stage. The lake drained southward through the Chicago outlet. Distinct shoreline features developed during this period. The ancient glacial lake covered ground moraines with lacustrine deposits consisting of clayey material. Then at the end of the Algonquin period, 7000 years ago, Green Bay was totally drained and the west shore rivers probably joined to form a great river flowing north draining across Little Bay de Noc into Lake Michigan. Green Bay then filled rapidly 4500 years ago (Bertrand, Lang and Ross, 1976).

2. Soils

The gradual sloping west shore of Green Bay is a combination of low erodible plains and wetlands which are subject to periodic and occasional flooding. Soils of the west shore area are mapped and found in Appendix A (U.S.D.A., 1974; Soil and Water Conservation District, 1977a and 1977b). Soils 1, 4, 6, 7, 8, 11 and 12 are of particular concern.

The Tendrow-Roscommon, Wainola-Deford, and Kinross-Deford-Angelica Associations of soils are the most widespread soils immediately inland of the Bay shore. These soils are loamy fine sands, fine sandy loams and loams of lacustrine origin which are deep, nearly level, and poorly drained. The water table in these soils is near the surface especially during wet periods. It is also low in natural fertility. This severely limits agriculture. Residential development and recreation (in the form of camping, picnicking and trails) are also limited due to wetness, flooding, or blowing when exposed soils become droughty. Most of these soils are in low quality woodlots, pasture, or brush and recommendations for use include a suitability for wildlife habitat, hunting and outdoor recreational education.

The Rousseau-Shawano Association is found mixed with the Wainola-Deford Association just south of the Oconto area and occurs on the lake borders and outwash plains. The association is comprised of loamy fine sands which are nearly level and moderately well drained to well drained. The soils are subject to wind erosion when exposed and are low in soil fertility, again limiting agricultural use. Most of the area of this soil type on the west shore is in second growth timber or brush. Some forms of recreation (camping, picnicking, and trails) are moderately to severely limited by repeated trampling and disturbance of the soil. Compatible uses include wildlife habitat, hunting, and nature observation and study.

The marshes and swamps adjacent to the Bay shore have developed moderately-deep and very poorly drained, nearly level, organic soils. The Carbondale-Cathro-Marsh Association dominates the southern West Shore-Peats Lake Unit. The Markey Muck Series occurs periodically along the entire west shore but is particularly evident in Peshtigo Harbor Unit. It is a herbaceous organic material over a sandy substrate and often occurs jointly with the Lupton Muck, a woody organic soil in the northern part of the west shore. Also present in the Peshtigo Harbor area is the Saprists Aquents, a variable inundated soil. All of these organic soils when drained are moderately suited to crops but when exposed, are subject to blowing and consolidation. The majority of these soils are vegetated with water tolerant grasses, sedges, shrubs and trees. Their use for timber production or as residential and recreational areas is severely limited with only wildlife habitat, hunting and education as compatible uses.

In general Green Bay West Shore soils limit agriculture to wet soil cultivation and pasture which is variable from year to year. Residential use (home sites and summer homes) is limited because the high water table restricts the operation of sewage disposal systems and many shallow wells become contaminated. Improvements which do take place are more prominent in some areas in years of low Green Bay water levels. Hiking trails, camping and picnicking are limited because of soil wetness and low soil trafficability.

Compatible uses of the west shore areas include hunting, fishing, nature observation, education and scientific purposes, and snowmobiling. Pond or pothole development is moderately limited due to the loose soil structure and inundation of land adjacent to the Bay. These developments and others i.e., level ditching and dikes with control structures, were previously constructed along the Bay (e.g., ponds in Rush Point and Pensaukee; dikes in Sensiba, Oconto Marsh and Peshtigo Harbor; and level ditching with ponds in Barkhausen Refuge-Peats Lake Unit). They proved successful and beneficial for wildlife, thus future developments on west shore soils should be good if sites are properly selected. The sites should be located inland to protect the integrity of the littoral areas and be least affected by water level fluctuation.

3. Hydrology

Green Bay is the most dynamic element of the Green Bay West Shore system. Water activity in the form of long term water level fluctuations, short term water level fluctuations and wave action appear to significantly regulate plant community stability and succession on the west shore (Harris, Bosley and Roznik, 1977).

Long term water level fluctuation operates within a time span of 10-30 years with a water level change of as much as six feet. Short term water level fluctuation occurs in the form of annual fluctuation with water changes of one to two feet and seiche activity with 2.5 daily cycles and water changes from a few inches to two feet per cycle. Wave action hinges on storm and wind activity and may amplify the other water level movements. All of these water level fluctuations and actions, coupled with the gradual sloping topography of the west shore, inundate and drain large portions of the coastal marshes along Green Bay and dramatically influence all components of the system.

B. Wildlife and Fish

The Green Bay West Shore contains a high diversity of wildlife species common to open water, sedge-meadow, emergent, shrub-carr, swamp hardwoods, and associated upland communities.

Mammals common to the west shore region include approximately 50 species of which those considered as game animals are the white-tailed deer, gray and fox squirrel, cottontail rabbit, snowshoe hare, and raccoon. The gray fox, coyote and black bear are less common species that may be found in the project. Mammals present which are classified as furbearers are muskrat, mink, red fox, weasel, striped skunk, beaver, otter and raccoon.

White-tailed deer are found throughout the project and currently have an over winter population of approximately 20 deer per square mile of deer habitat. In units (Peats Lake and Long Tail in particular)

located near populated residential and agricultural areas, the deer can at times present problems in the form of minor garden and crop depredation. Raccoons and skunks are also abundant in all West Shore units and contribute to nest predation of waterfowl and shorebirds particularly in years of low precipitation. The muskrat population on the west shore is currently at a low level. As water levels on Green Bay-Lake Michigan eventually decline and re-vegetation of the coastal areas occur, muskrats are expected to increase. No endangered or threatened mammal species are found in project boundaries. However, two mammals of watched status, the bobcat and fisher, may be found on or near northern West Shore units.

Birds, both game and non-game, on or near the west shore exceeds 350 species of which 136 breed in the area (Strehlow, et. al., 1978). The west shore has historically been a major waterfowl breeding and feeding area in Wisconsin. Breeding waterfowl includes mallards, blue-winged teal, gadwall, black duck, shoveler, Canada goose, wood duck, green-winged teal, wigeon, pintail, ruddy duck and redhead. Two state owned impoundments, Sensiba and Oconto Marsh, are the most productive sites on the west shore, producing from 2-3 ducklings per acre of brood water. Barkhausen Refuge (county owned; located in the Long Tail Unit) annually produces between 8-12 broods of Canada geese. The Wildlife Sanctuary, located south and east of the project, produces about 150 geese annually. Also, a few broods are raised on the islands of Green Bay and along the west shore. All these areas contribute to the lower Green Bay flock.

In addition to breeding waterfowl, the shoreline zone and shoals of Green Bay serve as significant staging areas for ducks (primarily divers) in both spring and fall. In October, 1977 and April, 1978 aerial counts along shoreline waters of migrating waterfowl on lower Green Bay were 29,600 and 15,200 divers respectively. (U.S. Fish and Wildlife Service, 1978) Rafting species include greater and lesser scaup, common merganser, red-breasted merganser ringneck, golden-eye, redhead, canvasback, old-squaw, bufflehead and ruddy duck. Spring time migrants also include whistling swans which may be present in concentrations up to 3,000 birds. Other game birds common on the west shore are ruffed grouse, woodcock, snipe and coot.

The west shore also serves as an important breeding area for colonial nesting and limicoline species such as great blue heron, black-crowned night heron, cattle egret, green heron, herring gull, ring-billed gull, and black tern. The shoreline zone is also a favored flight lane for many species of shore birds of which only the spotted sandpiper, greater yellowlegs, and killdeer nest in the project. The upland sandpiper and yellow rail are also found within the project boundaries.

The double-crested cormorant, Forster's tern, and common tern are state endangered species which nest in lower Green Bay. The population of double-crested cormorants in 1978 consisted of 125 adult birds. They constructed 34 nests on artificial nesting platforms erected in March, 1978 and produced 60 young. The Forster's tern and common tern also nested on the west shore and islands of Green Bay.

Forster's terns numbered about 200 adults which produced 40-45 young. One hundred and nine nesting pairs of common terns were recorded in 1978. The loggerhead shrike (threatened) has also been sighted on the west shore.

The west shore serves as an important migration corridor and breeding area for many raptors (hawks and owls). The Federal Banding Station in the Tibbet-Suamico Unit annually bands 500 of these birds of prey. The peregrine falcon (endangered), Cooper's hawk and red-shouldered hawk (threatened), and the harrier utilize the migration corridor.

In general the west shore contains a high diversity and abundance of avifauna, both breeding and transient species. By maintaining the littoral and shoreline areas in a natural state, the project should continue as a major bird use area. At the same time, the potential for increased productivity of upland nesting ducks and geese is excellent with certain management practices (impoundments, dikes, level ditching, ponds, and DNC) implemented away from the immediate shoreline zone; waterfowl production can be increased and non-game species benefitted.

Reptiles and amphibians common to the Great Lakes Region are found throughout the West Shore project. These species have not been intensively studied or surveyed. Some species present include, garter snake, fox snake, red-bellied snake, map turtle, snapping turtle, painted turtle, Blanding's turtle, and wood turtle (endangered species). Bullfrogs are common in the Sensiba and Little Tail Units with chorus, cricket and wood frogs and tiger and spotted salamanders (threatened) present throughout the entire project.

The coastal marshes of the west shore provide spawning and nursery areas for many species of fish. Others use the littoral zone at various stages in their life cycle. Approximately 33 species of fish are common along the west shore which includes yellow perch, bullhead spp., white sucker, northern pike, walleye, alewife, and carp. Longear sunfish (threatened) are known to frequent Pensaukee and Suamico Rivers. Littoral zones adjacent to Peats Lake, Long Tail and Little Tail Units are key spawning and rearing areas for yellow perch and northern pike. Crayfish were abundant in Green Bay up to the late 1960's and were actively harvested. Today, though crayfish boxes are still present, very few are taken.

C. Vegetation Cover.

The vegetation on the west shore is primarily composed of 22 cover types of which six types account for 91% of the cover within project boundaries. The six types are emergent vegetation, willow, swamp hardwoods, aspen, grassland, and farmlands. Cover type classification, unit cover type maps and cover acreages (Table 1) are found in Appendix A.

The vegetation present is characteristic of Type I-IV Wetlands (Shaw and Fredine, 1956) and associated uplands (see Appendix A). These types of vegetation occur on a gradient inland from the

waters of Green Bay. The vegetation on the gradual sloping topography responds to changes in the level of Green Bay. As the long term water level of Green Bay-Lake Michigan decreases, the wetland vegetation (predominately cattail-Typha, bulrush-Scirpus, and willow-Salix) advances lakeward. As water levels increase the vegetation retreats.

Currently Green Bay water levels are approximately 578 feet (IGLD) and emergent vegetation occupies 1,255 acres (9%) along the west shore. The emergent vegetation is expected to increase as Green Bay water levels decrease, and occupy its former range which is approximately four to five times its present area (Bosley, 1976). Emergent vegetation provides excellent waterfowl brood rearing areas, bird habitat, and furbearer habitat. The Bay water regime far over shadows any human management technique to enhance such areas.

Adjacent to the emergent vegetation in most project units lies a willow area. This is, currently, the predominate cover type on the west shore and covers 3,809 acres or 30% of the project, most occurring in Peshtigo Harbor Unit (See Table 1.). The willow community is relatively unproductive in terms of nesting wildlife or forest products and offers limited management opportunities. Willow is resistent to control by burning, water level manipulation, and mechanical techniques. The area is best suited for runoff ponds and impoundments in units, Tibbet-Suamico, Pensaukee, Rush Point, and Peshtigo Harbor.

Forest cover on the West Shore is limited to trees adopted to wet poorly drained sandy soil. Forest reproduction may become established during periods of low water only to be destroyed during years of high water. Swamp hardwoods cover 21% (2,704 acres) of the project. They are generally immature and of little value now as merchantable forest products. Aspen found on the West Shore is (see Table 1) covers 20% (2,519 acres) of the area. The stands are scattered and variable in size and quality.

The majority of the grassland on the west shore is abandoned agricultural fields and is reverting back to woody vegetation. This cover type will be developed and maintained as dense nesting cover (DNC) for waterfowl. In Pensaukee and Peshtigo Harbor Units, various prairie grass species and associated grass species are found such as Andropogon gerardii, Spartina pectinata, and Andropogon scoparius. These unique grassland and prairie species will be maintained as demonstrative and educational sites. Tubercled orchid (Habenaria flava), a threatened species has been found on the west shore near Suamico.

Farmland or agricultural land represents only 5% (775 acres) of the land within the project boundaries. This land is not prime agricultural land but rather marginal cropland. Much of this land is only productive in dry years and if left fallow would quickly revert back to willow and aspen. This farmland and the remaining farmland in the project can be developed in DNC or allowed to return to natural cover. In the Long Tail Unit, farmland accounts for 418 acres (54% of the farmland in the project). Some of this land has potential as sharecropped food patches for Canada goose management.

The impoundments in Sensiba and Oconto Marsh provide excellent demonstrative and educational areas of aquatic macrophytes such as Hippuris vulgaris, Lemna trisulca, Potamageton sp. Nuphar sp. and Nymphaea sp. In other areas where unique or rare plant species such as Spartina pectinata, and others occur, an attempt to maintain these areas will be made. No endangered or threatened vascular plants have been recently documented along the west shore but appropriate management will be taken if any are found.

D. Water Resources

Eleven water areas flow through or adjoin the property boundaries of the project, which are; Green Bay, Duck Creek, Barkhausen Impoundment, Suamico River, Sensiba Impoundment, Little Suamico River, Tibbet Creek, Pensaukee River, Oconto River, Oconto Marsh Impoundment, and the Peshtigo River. Information cited from Nelson and Fassbender (1972) and Carlson, Andrews and Threinen (1975 and 1977).

1.) Green Bay of Lake Michigan is an elongated body of water approximately 119 miles long, 23 miles wide with an average depth of 65 feet (Bertrand, Lang and Ross, 1976). All West Shore Units at least partially adjoin Green Bay. The water regime of Green Bay includes long term and annual water level fluctuation, seiche movement and wave activity which is the most influential factor affecting all aspects of the west shore. The current level of Green Bay is 578 feet (IGLD) which is three feet lower than the most recent high of 581 feet in 1973 and three feet above the recent low of 575 feet in 1964.

The total Green Bay watershed drains approximately 15,625 square miles of the Lake Michigan drainage basin with only the Wolf-Fox River system, Oconto River, and Peshtigo River of major importance in lower Green Bay. The Fox River, Oconto River, and Peshtigo River are major sources of pollution to Green Bay due to the concentration of pulp and papermills and the subsequent waste discharge. Additional pollution loads from municipal sewage plants, urban runoff and farmland runoff enters Green Bay from ditches, streams and rivers.

A marked decrease in water depth in the last 20 years in lower Green Bay from the high sediment loads of inflow rivers is also a major problem (Ditton and Goodale, 1972). However, water quality in Green Bay has improved in the last few years resulting primarily from compliance by water users of Green Bay rivers to federal water quality standards. Additional improvements are expected when nutrients and erosion from urban and farmland runoff are brought under control.

The management of fish in Green Bay focuses on the protection of critical littoral areas used for spawning and nursery grounds, the stocking of walleyes and control of commercial harvest. The West Shore project is an integral part of this management program.

2.) Duck Creek flows through the southern part of the West Shore project with approximately 1.2 miles of shoreline bordering the Peats Lake Unit. The river is 13.8 miles long draining approximately 142 square miles. Water flow in Duck Creek may approach zero in dry years because of the small amount of ground water recharge. Flow reversal is experienced at times, particularly on the lower four miles of the river resulting from Green Bay water level fluctuation and seiche activity.

A major wetland area exists where an intermediate stream enters Bakers Slough of Duck Creek in the Peats Lake Unit (see Appendix B). This area has waterfowl potential and in years of lower Green Bay water levels harbors a substantial migratory snipe population. Fish in Duck Creek consists of bullhead spp., carp, yellow perch, and northern pike. In Spring, Baker's Slough is a significant northern pike spawning area. The perch population is substantial in lower Duck Creek with an estimated population of 312,000 fingerlings found for October-November, 1977 (Kernen and Hawley, 1977).

3.) Barkhausen Impoundment is part of the Barkhausen Refuge which is owned and managed by Brown County. The area is located in the Long Tail Unit, one half mile inland from Green Bay (see Appendix B). The impoundment is a series of dikes and water areas of approximately 160 acres, connected to Green Bay by a canal type ditch which is a major spawning area for northern pike. The refuge is managed for waterfowl and has a good breeding population of mallards, blue-winged teal and Canada geese, and an excellent population on non-game birds. Furbearers and deer are also common. Current management policies are expected to continue.

4.) Suamico River flows between Long Tail and Sensiba Units (see Appendix B). The river is 19.4 miles long and drains approximately 80 square miles. It is a clear stream at its headwaters and a sluggish, wide and a very turbid stream in its lower reaches. The fishery is the same as that of lower Green Bay with both yellow perch and northern pike using the stream and its tributaries for spawning. Developments are confined to around the Town of Suamico including the part inside the west shore boundary. Public access is available at the Brown County boat landing where an eight foot deep navigational channel is maintained from the mouth to a half mile up the stream.

The water quality is much the same as Duck Creek. However, a town dump near the upper end is a possible source of pollution. Cattle pasturing is also contributing to the nutrient and erosion problems along the stream.

5.) The Sensiba Impoundment covers approximately 150 acres and can be flooded or dewatered from a water access to the Suamico River. The surrounding dike inhibits the various water movements of Green Bay, enabling many species of aquatic plants to develop. The impoundment also contains an abundant invertebrate population which is an important factor in the annual production

of 2-3 ducklings per acre of brood water. The area contains a high diversity of game and non-game species of birds, both resident and transient, thus, is a prime Brown County bird watching area. The Sensiba impoundment is closed to hunting during waterfowl season.

6.) Little Suamico River is 16.8 miles long with an average width of 21 feet. The hard water stream enters Green Bay through the Tibbett-Suamico Unit. Forage fish species comprise most of the fish population, although a few northern pike and panfish are present. Waterfowl and furbearers make light use of this stream with more extensive use by great blue herons and green herons for nesting. Public access is available at nine road crossings.

Water quality of the stream has declined in recent years due to the intensive agricultural use along the stream causing erosion and an increased nutrient level in the water. Land adjacent to the stream in the project is best left in a natural state and areas utilized by colonial nesting birds should be protected.

7.) Tibbett Creek flows into Green Bay a mile north of the Little Suamico River through the Tibbet-Suamico Unit. The stream is approximately 6 miles long with an average width of 12 feet. Fish present include the same species found in the Little Suamico River. However, the stream mouth is an important perch spawning and nursery ground. The west shore land adjoining Tibbet Creek should be left in a natural state with the adjacent higher land developed as DNC. This should increase present light use of the area by waterfowl.

8.) Pensaukee River enters Green Bay between the Pensaukee Unit and the Pecor Point Unit (see Appendix B). It is a hard water river which is 28.2 miles long and averages 34 feet wide with an average discharge of 153 cubic feet per second. The fish population consists of northern pike, perch, carp, panfish, white sucker, and forage species. The river is a major white sucker spawning stream. Rough fish contracts have been let for several years and an average of 500,000 pounds have been netted in spring over the last three years. Furbearers and waterfowl make limited use of this stream. As along most streams entering Green Bay on the west shore, agriculture is the main land use and presents the primary detriment to stream quality. The area of the Pecor Point Unit adjoining the Pensaukee River is expected to remain in a natural state.

9.) The Oconto River is a hard water river, 44.2 miles long with an average width of 106 feet and an average flow of 581 cubic feet per second. It enters Green Bay through the Oconto Marsh Unit (see Appendix B). Fish found in the river include northern pike, walleye, largemouth and smallmouth bass, panfish, carp and trout. Brook, brown and rainbow trout inhabit the upper portion of the river where it is a Class III trout water. Seasonal runs of trout and coho salmon occur at the mouth.

Wildlife inhabiting the river area include such furbearers as muskrat, mink, otter and beaver. Mallards, blue-winged teal, and wood ducks nest on the river and migratory waterfowl use the river as a staging area.

The river from Oconto Falls down stream contained a heavy industrial pollution load until the pulp mill in the area closed down. Currently water quality in this area is rapidly improving. Land use within the watershed is agricultural and forest production. The river adjoins only a small part of the Oconto Marsh Unit and no consideration other than natural use is expected for this area.

10.) Oconto Marsh Impoundment is located just northeast of the City of Oconto on the shore of Green Bay. The marsh consists of a 224 acre impoundment whose water level generally responds to the water level of Green Bay. However, the water level can be mechanically manipulated.

Bird observations in recent years on the marsh area included such uncommon species as the Louisiana heron, little blue heron, great and snowy egrets, glossy ibis, and little gull which makes the area very popular for bird watching. Waterfowl also make extensive use of the area for breeding and as a staging area.

Furbearers, particularly muskrats are abundant some years; usually in response to Green Bay water levels. The impoundment is managed for waterfowl and is closed to hunting. This type of management is expected to continue for this water area.

11.) The Peshtigo River enters Green Bay through Peshtigo Harbor Unit, the largest unit of the West Shore project (see Appendix B). The river is 66.7 miles in length and averages 123 feet wide. Six flowages are located on this river and all are used for hydroelectric purposes. The Badger Paper Mill at Peshtigo is also located on the river a few miles before it enters Green Bay.

The upper reaches of the river is classified as trout water downstream to the Sandstone flowage. This stretch of stream contains brook, brown, and rainbow trout. Chinook salmon, rainbow trout and brown trout are also abundant from the river mouth up to the dam in the City of Peshtigo. The rest of the river contains warm water fish such as northern pike, walleye, largemouth and smallmouth bass, panfish and white sucker.

Furbearers and waterfowl found along the rest of the west shore are also found here. The watershed is primarily forested with only limited areas of agricultural land. Recreational use on or near the river includes hunting, fishing, canoeing and camping.

The Peshtigo River enters Green Bay through very low land which in times of high Green Bay water levels is inundated.

Many sloughs and old riverbeds exist and offer excellent opportunites for such management tools as runoff ponds and impoundments. The area is currently managed as a wildlife area.

E. Historical and Archaeological Features

Indian and early exploration encampments, villages, mounds, cemetaries, lights and bridges exist along the West Shore of Green Bay. To date, 28 specific sites have been identified and are listed in Table 4 in Appendix B. An archaeological and historical survey of the West Shore region is currently underway and will be completed by fall, 1979. This will more thoroughly identify all known sites. All sites will be considered in the management of the west shore particularly in areas of future development.

F. Ownership

The acreage goal within the eleven units of the Green Bay West Shore is 13,933 acres which may vary slightly due to accretion land. Currently 5,209 acres have been acquired through fee simple acquisition leaving a balance of 8,724 acres. Of the remaining acreage, Brown and Oconto Counties own 1,040 acres in the project boundaries, leaving 7,684 acres in private ownership. Privately owned land has been ranked in order of priority (to be discussed in the Recommended Management Program Section) and is referred to in Table 2 along with ownership and dwellings (found in Appendix A).

The majority of state owned land is currently used as wildlife areas, with 59 acres for fish management and 110 acres as a scientific area (Charles Pond Unit). The county owned land in the Peats Lake Unit and the Long Tail Unit is managed for waterfowl and the county land in the Rush Point Unit is managed for forest products. These uses are expected to continue and fit into the continuity of the West Shore project. Interest in acquisition of these county lands will not take place unless management uses change and conflict with West Shore goals and objectives.

Much of the privately owned land within the project boundaries is in a natural state. It contains the majority of the remaining critical wetland areas along the west shore and their protection is paramount and necessary for a contiguous West Shore program. At present, only 6% of the land is used for agriculture (marginal cropland), however, this percentage increases in years of lower Green Bay water levels. Residential encroachment, the primary threat to wetlands of the west shore, also increases in years of lower Bay levels. Accompanying development is shoreline alterations such as bulkheads, dredging, and filling. All are detrimental to the integrity of the coastal areas and have a limited effect on the Bay. Thus it is desirable to purchase the available parcels and incorporate them into project management.

G. Current Use

Water-based recreation for both hunting and non-hunting activities is the primary use of the west shore. Hunting for waterfowl, deer, grouse and other small game, in that order of importance, is the most extensive use of the coastal areas. In 1977, 29,000 small game hunting licenses and 37,200 big game hunting licenses were issued to residents of Brown, Oconto and Marinette Counties. Also, in 1978, 4,100 state duck stamps were issued in the same three west shore counties. Hunting pressure is high opening weekends of waterfowl season and deer gun season, but decreases appreciably as the seasons progress.

Waterfowl hunting is extensive on the west shore with an estimated 12,500 participant-days of hunting for the 1978 season. This number represents a slight decrease from recent years possibly due to the incorporation of the State duck stamp and the requirement of steel shot on the coastal areas. Deer gun hunting, principally in Peshtigo Harbor, Sensiba, and the Clifford Marsh area, accounts for about 1,200 participant-days with only slight use for deer archery hunting. An estimated 800 participant-days for the pursuit of small game on wildlife areas are made each year, of which 200 participant-days are estimated for the stocked pheasants in Pensaukee. Hunting for grouse, rabbit, squirrels and woodcock occurs in all west shore areas. As the season progresses, the hunting pressure decreases. Trapping on the west shore has been very low for the past 10 years due to the lack of emergent vegetation for habitat and the concurrent lack of muskrats. As Green Bay water levels decrease, trapping should again become very popular.

Non-hunting use of the coastal areas and Green Bay has been increasing at a tremendous rate. Sport fishing is by far the most popular water-based recreational activity of the region. Approximately 23,000 fishing licenses are issued each year for Brown, Oconto, and Marinette Counties and 50% of these people fish on Green Bay throughout the year. In 1977, sport fishing harvested a little over 50,000 pounds of perch from Green Bay.

Commercial fishing for alewife, perch and other fish species is also important with 84 commercial licenses issued in 1978 for the three west shore counties. This accounted for a harvest of 468,421 pounds of perch and 80% of the fish harvested from all of Lake Michigan. Boating and swimming are the next two most popular uses of the west shore. In 1978 approximately 19,000 boats were registered for Brown, Oconto, and Marinette Counties, plus unregistered canoes and skiffs. Most of these make use of the Bay at some time during the year. For access to the Bay, eight public and five private boat access sites exist near the West Shore, with two of the public sites (location-mouth of the Fox River and Suamico River) able to accommodate boats in the 30 feet size range. These 13 sites are illustrated in Appendix B. Though swimming is discouraged in lower Green Bay, people still make use of the islands in Green Bay, Long Tail Point and Little Tail Point for these activities, including picnics.

Education and scientific study are important uses of the west shore. The unique freshwater coastal marshes of Green Bay, i.e., Peters Marsh, Long Tail Point, Sensiba, Little Tail Point, Oconto Marsh, and Peshtigo Harbor, are used extensively for study by the University of Wisconsin-Green Bay and the University of Wisconsin Center-Marinette. At least seven graduate research projects (some of which are DNR financed) and a University Sea Grant project have been undertaken. The wildlife areas are also important to the Boy Scouts and the various conservation groups for projects and environmental study. In addition, Sensiba and Oconto Marsh offer excellent bird observation opportunities.

Snowmobiling is popular along the shoreline of Green Bay. Trails are used in Sensiba and Peshtigo Harbor but these are mostly used for crossing to the Bay shore. With the Bay shore so accessible and intensively used for snowmobiling it is unlikely more trails will be developed on west shore land.

H. Land Use Potential

The uniform classification of land use potentials was used to designate four land use categories in the Green Bay West Shore Project. These are Habitat Preservation Areas (HP), Historical and Archaeological Areas (HA), Scientific Areas (S), and Fish and Wildlife Development Areas (RD_2). Each land use class is discussed below and is illustrated on the maps in Appendix B.

1. Habitat Preservation Areas are designated in all West Shore Units, except Charles Pond, to include the littoral and shoreline zone of the west shore along Green Bay. This area extends from the water zone with submergent vegetation landward to the indeterminate line along the shore where high water ice damage occurs.

   The coastal shoreline zone is constantly undergoing vegetation changes resulting primarily from water level fluctuation of Green Bay. As the long term water level of Green Bay increases and decreases over a span of 10-30 years, the acreage of the shoreline zone fluctuates by as much as five times. The water activity appears to regulate plant community stability and succession which in turn plays a direct and vital role in determining the use of the area by the various limicoline species.

   The littoral and shoreline zone is extremely productive in wildlife species and provides an important area for fish spawning and nursery grounds. The area should become even more important in terms of wildlife production when the various wildlife management techniques are implemented in adjacent Fish and Wildlife Development Areas. Thus, the Habitat Preservation Areas represent an important and vital aspect of the aquatic system of the west shore and the key to accomplishing the project goals and objectives.

2. Historical and Archaeological Areas are to be considered for the 28 known sites identified in Table 4 - Appendix B. These sites represent encampment areas of early Indians and settlers, cemetaries, mounds, trading posts lights, and a slough bridge. The specific site location will not be presented in the master plan because the sites are fragile and sensitive resources. Appropriate measures will be taken if significant sites are present in areas designated for habitat enhancement.

3. A Scientific Area has been designated for Charles Pond, a 110 acre wet-mesic forest located in the Charles Pond Unit (Appendix B). This area represents a unique native vegetation community and is managed to discourage public use and preserve the quality of the biotic system. The wetland complex on Green Bay is subject to the influence of water fluctuation of Green Bay. It is composed of second growth swamp hardwoods, a bay bar lake, and an extensive shallow marsh. The associated marsh and bay bar lake are used for waterfowl hunting, trapping and fishing, but for the most part, these uses do not conflict with scientific area requirements.

   Government Lot No. 2 in Section 15 in Peshtigo Harbor Wildlife Area represents an alkaline meadow complex (Natural Area) which will be preserved. The 10 acre parcel is completely surrounded by wildlife development land and has a limited access. The meadow is maintained by burning.

   No other areas outside of these two have been identified for Natural or Scientific Area classification. However, as unique areas are identified, the department will pursue Scientific Area designation with the assistance of the Scientific Area Preservation Council consistent with property goals and objectives.

4. The Fish and Wildlife Development Area classification is designated for the remaining land within the West Shore project boundaries. This includes land presently owned by the State and private land. This classification will allow maximum wildlife production without sacrificing the unique coastal wetland communities. Much of the land on the west shore is monotypic emergent, willow, or swamp hardwood vegetation that contains less than ideal natural conditions for fish and wildlife production. The marginal habitat, however, can be developed with runoff ponds, impoundments, flowages, and particularly DNC in order to increase the potential for wildlife.

   This designation is also highly compatible with Habitat Preservation Areas of the shoreline region, in that, together the project goals and objectives can be realized. Refuges and closed areas are valuable tools in Fish and Wildlife Development Areas of the west shore. However, no new refuges or closed areas will be established on the west shore except for (1) land adjacent to pre-existing refuge or closed areas, (2) for the protection of critical nesting areas of double crested

cormorants (endangered), Forster's terns (endangered), common terns (endangered), great blue herons, black-crowned night herons, and other endangered or threatened species, and (3) for protection of fish spawning and nursery grounds, primarily yellow perch.

Expansion of closed and refuge areas may take place around Barkhausen Refuge (County owned), Sensiba, Oconto Marsh, and Peshtigo Harbor. Establishment of closed areas are planned for the colonial nesting sites of the Islands of Green Bay and for designated areas in and along Green Bay. While State law adequately prohibits the removal and subsequent transportation of endangered or threatened species of plants, further protection through the utilization of "No Entry Refuges" may be necessary in the future. If any such plants are discovered during development, the Office of Endangered and Non-game Wildlife (DNR) will consulted and plans modified if necessary.

In addition to the 13 boat access sites servicing the West Shore (8 public and 5 private), eight potential sites have been identified. Currently, these sites can be used for access with canoes, skiffs and car top boats without any development (see maps in Appendix B).

IV. RESOURCE MANAGEMENT PROBLEMS

Problems in resource protection and development exist today on the west shore and are anticipated in the future. Problems which may significantly affect the project are listed and discussed in the following paragraphs.

A. Private development encroachment is a major threat in all portions of the West Shore project. The movement of people from the central city out into the metropolitan fringe is a matter of particular concern as urban sprawl continues. The demand for private shoreland property and year-around residences can be expected to increase, putting pressure on wetlands, both economically and ecologically. Residential development has moved northward from metropolitan Green Bay up the west shore at an accelerated rate. Presently, 65% of the land between Green Bay and Marinette is in a natural state, either as forest, agricultural-undeveloped, wildlife, or recreational land with 34% as residential and 1% as industrial-commercial. The remaining property in a natural state will be put under even more development pressure in the future spawned by the use of holding tanks, mound septic systems, and sewage treatment plants. In addition to the actual developments is the concurrent shoreline alterations such as filling, dredging, riprap, and diking to protect or enhance the developments. This often results in wetland despoiliation.

B. Private inholdings will disrupt the continuity of the project and may potentially create other management problems relating to wildlife disturbance, access rights of way, complaints on hunting, trespass, fire, conflicting land use, fencing, animal damage, and others. The inholdings occur as single units and

development areas (e.g., houses in Peats Lake and Long Tail Units) and may result in special management policies and regulations. Many of the landowners involved in the project are not interested in selling and are expected to be there for many years. Consequently, they must be considered in all aspects of project management.

C. Public overuse at times, presents problems on the west shore. Through most of the waterfowl hunting season hunter use of the west shore is light. However, excessive hunting pressure exists on the opening weekends of waterfowl season. This results in overcrowding of the shore areas and a low quality hunt. It may also result in an overharvest of the local duck population which supplies much of the duck hunting along the west shore. Many species of breeding birds are often intolerant of any type of disturbance during the critical nesting season. Nature observation and other activities sometimes provide too much disturbance in such areas as the islands of Green Bay, Sensiba, and Oconto Marsh. The numbers of people and the time of the disturbance must be considered in the management.

Extreme caution must be utilized in preventing over-development or over-use of the fragile areas such as those set aside for Habitat Preservation and Scientific Areas. Water based recreation in Green Bay during the summer, in the form of swimming and boating, is very popular. Areas heavily used (Long Tail Point, Little Tail Point, and islands of Green Bay) often show the results of such use in littering, trees cut for firewood, disturbance to nesting birds, and trampling of vegetation. Constant monitoring of the project is necessary to insure protection and yet achieve maximum compatible use.

D. Conflicting uses will become more pronounced as the project is developed. Conflicts between summer water based recreation and undisturbed nesting habitat for threatened and endangered bird species is evident on Long Tail Point, Little Tail Point, and the islands of Green Bay. As the population of nearby towns and cities expand, recreational use also increases. This puts pressure on the limited coastal areas used jointly for recreation and by breeding birds. Another conflict in use which arises as more project land is made public, is the demand for access points and small boat harbors. These conflict with the habitat preservation status of the shore and littoral areas. Careful consideration must be afforded to resource use of the land as to accomplish project goals and objectives.

E. Poor water quality in Green Bay and many of its tributary rivers is a significant problem affecting the project. The establishment of pollution abatement programs has greatly improved the water quality of these water resources with respect to nutrient and biological oxygen demanding (BOD) waste. However, problems with polychlorinated biphenols (PCB), sediment deposition, and the stirring of the sediments

from wind, wave action and dredging are still major problems. The carp fishing industry has been closed in Green Bay due to the high PCB content in the fish. Also, due to PCB content, salmonids caught hook and line from Green Bay are not recommended for human consumption in quantities of more than one meal per week.

F. Public misuse on the west shore with respect to hunting and fishing violations, littering, vandalism, firewood and soil theft, unauthorized use of motorcycles and four wheel vehicles, and duck blind removal presents law enforcement problems. The project is 42 miles in length making the patrolling of the property and the apprehension of violators rather difficult. As the project becomes established, law enforcement personnel should increase patrolling efforts which coupled with educational management programs, should decrease the misuse of project land.

G. Fluctuating water levels of Green Bay have a tremendous impact on the west shore. Water level fluctuation occurs in three major forms, long term, annual, and seiche movements (discussed in water resource section). These water level changes in Green Bay cause extensive property damage to shoreline developments and structures and cause a loss of revenue. In many cases expensive dredging and filling is attempted to combat the problem. The natural shoreline is regulated by the water movement and though, dewatered or inundated, shows little damage. However, problems arise on project land when existing ponds and impoundments are flooded or dewatered and must be mechanically manipulated, and the dikes repaired. The water level fluctuation problem must be taken into account in the development of all West Shore project land.

H. Avian botulism and lead poisoning present a problem in the project from time to time. The west shore has historically been heavily used for waterfowl hunting. Tremendous amounts of lead shot were deposited on the shoreline and littoral areas in the fall. Areas of heaviest use often contain sediments of detritus and muck, in which lead shot sinks, thus, in most instances does not result in a problem. However, as the water levels change, lead shot may result in some waterfowl deaths. In the 1978 waterfowl season, lead shot was banned and steel shot required for 12 gauge shotguns and subsequently will be required for other gauges in the future. This should alleviate most future problems of lead poisoning on the west shore.

Botulism losses in waterfowl and shorebirds are substantial when the right conditions develop in areas of the west shore. Peters Marsh, Long Tail Point, Little Tail Point and the Bayport Industrial Park (not in the project) have a history of botulism outbreaks. In 1977 losses in these areas ranged from 800-1,800 birds. Little can be done to control the outbreaks when conditions develop, but a contingency plan and monitoring program developed in 1977 should reduce losses.

I. Wild animal damage is currently a minor problem. Complaints of deer depredation on corn, alfalfa, and gardens are few in number, and not likely to change as more land is acquired. In addition, complaints of woodchucks, rabbits, squirrels, and other small animals causing damage occur in the developed areas in and adjacent to the project. Such damage may increase but no major problems are foreseen.

J. Carp are abundant in all tributaries and connecting waters of Green Bay. Carp are a factor in the disturbance of submergent, floating and emergent plant growth of the Bay shore and also contribute significantly to water turbidity. The impoundments, ponds and ditches in the project all contain carp at various times. Although, there is some winter kill, it appears to have little effect on the population. The full impact of carp on the achievement of project goals and objectives is not realized at this time, but it is possible that management to control carp may be implemented in the future.

K. Willow encroachment is a significant and ever present threat to maintaining productive waterfowl habitat. Shrub willow presently occupies approximately 30% of the West Shore project and is very difficult to control offering resistence to burning, flooding, and mechanical techniques. The willow sere is an excellent erosion buffer in high water years, however, it must also be viewed as a problem to be considered in West Shore management activities.

V. LONG RANGE RESOURCES, RECREATIONAL NEEDS AND JUSTIFICATIONS

A. Wetland protection in Wisconsin is paramount today and for the future. Currently, Wisconsin has approximately 2.5 million acres of wetlands of which about 1% are lost annually to residential development, agriculture and industry. Wetlands supply wildlife and fish habitat, breeding grounds, ground water storage or recharge areas, erosion buffers, outdoor classrooms and labs for students and scientists, nutrient sinks, and open space for areas of high population density (W.D.N.R., 1976). For these functions, wetlands are invaluable and once altered or destroyed can never again yield such benefits.

Remaining coastal wetlands along Lake Michigan in Wisconsin occupy only 30 miles of Wisconsin's 495 mile Lake Michigan shoreline, most of which are located in the 42 miles of the West Shore project. The health and well-being of the Green Bay ecosystem depends on how the shoreline zone is used. The west shore coastal wetlands and associated uplands are approximately 65% in a natural or semi-natural state, but development pressure from an expanding population is increasing rapidly. Thus, these coastal wetland areas must be protected from further despoiliation if wetlands are to benefit us in the future.

B. Wildlife habitat for the production of waterfowl, shorebirds, limicoline bird species, furbearers, and fish is decreasing each year. The west shore littoral zone, wetlands, and uplands supply critical habitat needs for a high diversity and abundance of wildlife species. Much habitat has already been lost (70% since 1840) and subsequently wildlife has also decreased, (Bosley, 1976).

Double crested cormorants, Forster's terns, common terns (all endangered), and other limited status species nest in the lower Green Bay and will be lost if their breeding habitat is reduced or altered further. Waterfowl hunting depends largely on locally reared ducks. Use of the area by migratory waterfowl and non-game bird species, as a staging area, is variable depending on many factors, most of which hinge on the attractiveness of the habitat.

Green Bay also provides sport and commercial fishing for the surrounding area, principally for yellow perch. The fishery depends on the coastal wetlands for critical spawning and nursery habitat. Many fish species have been lost to the Bay but re-introduction may be possible with improving water quality and habitat conditions.

Any further habitat loss or degradation will ultimately result in a decrease of wildlife and fish species. Habitat preservation and management are needed as the human population expands and the demand for wildlife based recreation increases.

C. Hunting - With increased development of natural areas and agricultural land statewide as well as in Brown, Oconto and Marinette Counties, and continued posting of private lands, pressures on public land will increase over the next decade. The current population of Brown, Oconto, and Marinette Counties is approximately 240,900 people, and by 1990 is expected to increase by 22% to 294,000. Hunting pressure will also increase on all land available for hunting, public or private. On the west shore, residential development is the major threat to hunting by permanently removing land from the hunting roles. During years of lower Green Bay water levels, agriculture and shoreline alterations increase, which also tend to limit hunting opportunities and increase pressure on the remaining public land. This leads to a problem of high hunter numbers and low quality hunts, particularly on opening days of waterfowl season. Control of hunter numbers during peak day use to prevent overuse and the establishment of safety checks to promote quality hunting conditions may be necessary.

D. Outdoor education opportunities supplied by the coastal marshes, wetlands and uplands of the west shore are unique. The wetlands possess characteristics of marine estuaries and glacial pothole marshes. Avian species diversity and abundance in this area are among the highest in the state. The west shore attracts various University undergraduate, graduate and

post graduate study efforts examining many facets of the coastal areas (water movement, birds, fish, invertebrates, vegetation, and people). In addition, exercises by the local Boy Scout troops, conservation clubs, and citizens are considerable, relating to such activities as outdoor study, construction of nesting boxes and platforms for wood ducks and cormorants, nature hikes, and others. All of these educational experiences have been important in the past and will become even more important as the surrounding population expands.

The uniqueness of these coastal areas in providing specific areas of study and natural open space are unsurpassed along Lake Michigan. The need to protect, preserve and make available these natural facilities are an important part of this project.

E. Non-hunting recreational use, as with hunting and outdoor education, will also be in greater demand in the future. Activities such as swimming, boating, canoeing, cross-country skiing, and sport fishing are generally compatible with project goals and objectives and will be an additional benefit of the project. However, at times recreational uses such as (swimming, boating and canoeing) can conflict with habitat preservation, scientific areas, bird nesting, and waterfowl production. These activities may have to be controlled or possibly curtailed in certain areas (parts of Long Tail Point, Little Tail Point, and the islands of Green Bay). Other recreational uses such as cross-country skiing and sport fishing take place at times of the year or in areas, that for the most part, do not conflict with project strategies.

VI. RECOMMENDED MANAGEMENT PROGRAM

A. Property development in terms of land use and area designations is listed on maps in Appendix B. Four land use classes are recommended; Habitat Preservation-HP, Historical and Archaeological-HA, Scientific-S and Fish and Wildlife Development-RD_2.

An Historical and Archaeological Area is listed for the lighthouse on Long Tail Point but the mouth of the rivers entering Green Bay through the project will be given consideration in the future. The 28 sites identified in Table 4 will also be designated HA.

Regarding potential historical or archeological sites, all areas of development will be thoroughly investigated for the presence or absence of sites and appropriate protective measures will be taken for significant sites. If any are found during development, construction will be suspended until the State Historical Preservation officer is consulted. The site(s) will be evaluated and, if significant, would be preserved.

The only Scientific Area now located in the project is Charles Pond. This area will not be expanded. However, as other unique areas are identified within the project boundaries, more Scientific Areas may be established consistent with property goals and objectives.

The shoreline and littoral zone as far inland as the high water ice push will be designated as Habitat Preservation in order to protect these unique areas.

The remaining property of the west shore will be listed as Fish and Wildlife Development. Under this category the ultimate use of the property as stated in the project goals and objectives can be realized with management practices and developments.

B. Eleven units have been identified to further facilitate easy handling and reference of material pertaining to the west shore. The boundaries of the West Shore project are illustrated in Appendix B and were established by the project task force under the criteria of the minimum amount of land: (1) necessary to accomplish the goals and objectives, (2) which would lend itself to management, and (3) which is economically feasible to acquire.

Prior to formulation of the West Shore project, land had been acquired by the state in 9 out of 11 West Shore units. On approval of the West Shore project, a continuity of management, planning, and development will occur among the 11 Units on the west shore by forming one project. It is recommended the remaining land within the established boundaries of the West Shore project be purchased through fee simple acquisition.

Interim management or alternatives to acquisition will include easements and leases for flowages, public hunting grounds and access points; Acres for Wildlife; and Project Respect. Zoning of critical areas will also be pursued. However, these provide only temporary solutions to very complex problems relating to vanishing wildlife habitat. The only viable long term solution to protect these resources for the future is state ownership.

C. Land in the West Shore project has been ranked by priority into two levels for acquisition. Priority I is high priority land that shows an immediate need for acquisition; Priority II is medium priority land, land we are interested in purchasing but exhibits no immediate need. Maps illustrating state owned land, county owned land, and Priority I, II and "No Purchase" land, are found in Appendix B. County owned land is listed as Priority II land. Its current use is complementary to the project and no change from the current management policies is anticipated in the future. If changes in the county management policies should occur, the status of such land will probably change in the project to Priority I.

Costs of acquisition of Priority I and II land on the west shore varies from $250 per acre up to $700 per acre, depending on the distance of the parcel from City of Green Bay, whether upland or wetland, and if it is frontage property. Estimated costs for Priority I land are listed on Table 2 (Appendix B).

Priority II land is county owned land or land in small parcels with improvements. Cost of acquiring Priority II land was not estimated, however, land costs would be approximately the same as Priority I land plus the improvements. Priority II land occupies only about 1,128 acres of the West Shore project. Funding or money for acquisition will be derived from Pittman-Robertson (P-R), Dingell-Johnson (D-J), Land and Water Conservation (LAWCON), and Segregated Funds.

D. Management developments that exist and potential developments for the west shore are illustrated on the maps in Appendix B. Future development projects such as dikes, impoundments, runoff ponds, nesting platforms, etc., are all contingent on land acquisition and state ownership. Subsequently, the estimated cost and location of the developments are highly variable. However, estimates of future major developments which have potential in areas of the west shore are listed in Table 3 (Appendix B).

Currently, the 8 boat access sites can be used for canoes, skiffs, and car top boats. These potential sites will be expanded when a need for such facilities develops (Appendix B).

The Bay-Lake Citizen's Task Force has requested assistance from Wisconsin's Coastal Management Council to investigate and resolve the carp problem in Green Bay. The management of this project will be active in pursuing ways to alleviate the carp problem.

In addition to wildlife management practices, forest management practices will be implemented to enhance habitat. Generally, the woody species present consist of aspen and swamp hardwoods. The aspen will be harvested for regeneration at rotation age contingent on wildlife management. Swamp hardwoods will be selectively managed which will include harvesting at pathological rotation age. This will also take place in accordance with project goals and objectives. Various oaks and pines are present throughout the project in scattered clumps. These will be managed in a manner to perpetuate the species.

All developments will be located in Fish and Wildlife Development areas, inland from the shoreline designated as Habitat Preservation. The developments will for the most part be located in the willow zone which occupies 30% of the project and is currently not very productive. Also in this area runoff ponds not listed in Table 8 may be excavated if such development will enhance the project goals and objectives. Funding for the developments, operations and maintenance will be from P-R, D-J, Duck Stamp money and Segregated funds.

The acquisition of land and the establishment of developments in the West Shore project will proceed at an undetermined time schedule contingent on the willingness of landowners to sell and the availability of funding for such activities. Upon approval of the West Shore project, more time and money will be allocated for wildlife management, fish management, and law enforcement which will allow the project to proceed at maximum speed.

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Glossary

Closed Area - An area where it is unlawful to hunt any species of wild animal, bird, or fish during a specified period of time.

DNC - Dense nesting cover.

Limicoline Species - Inhabiting the shoreline region.

Littoral Zone - Shoreward region of a body of water.

Marsh - A wetland consisting of herbaceous emergent vegetation.

Participant Day - One day visitation consisting of at least four hours.

Refuge - An area where it is unlawful to hunt, trap and enter (when specified) to protect species present.

Seiche - A tide-like water level fluctuation.

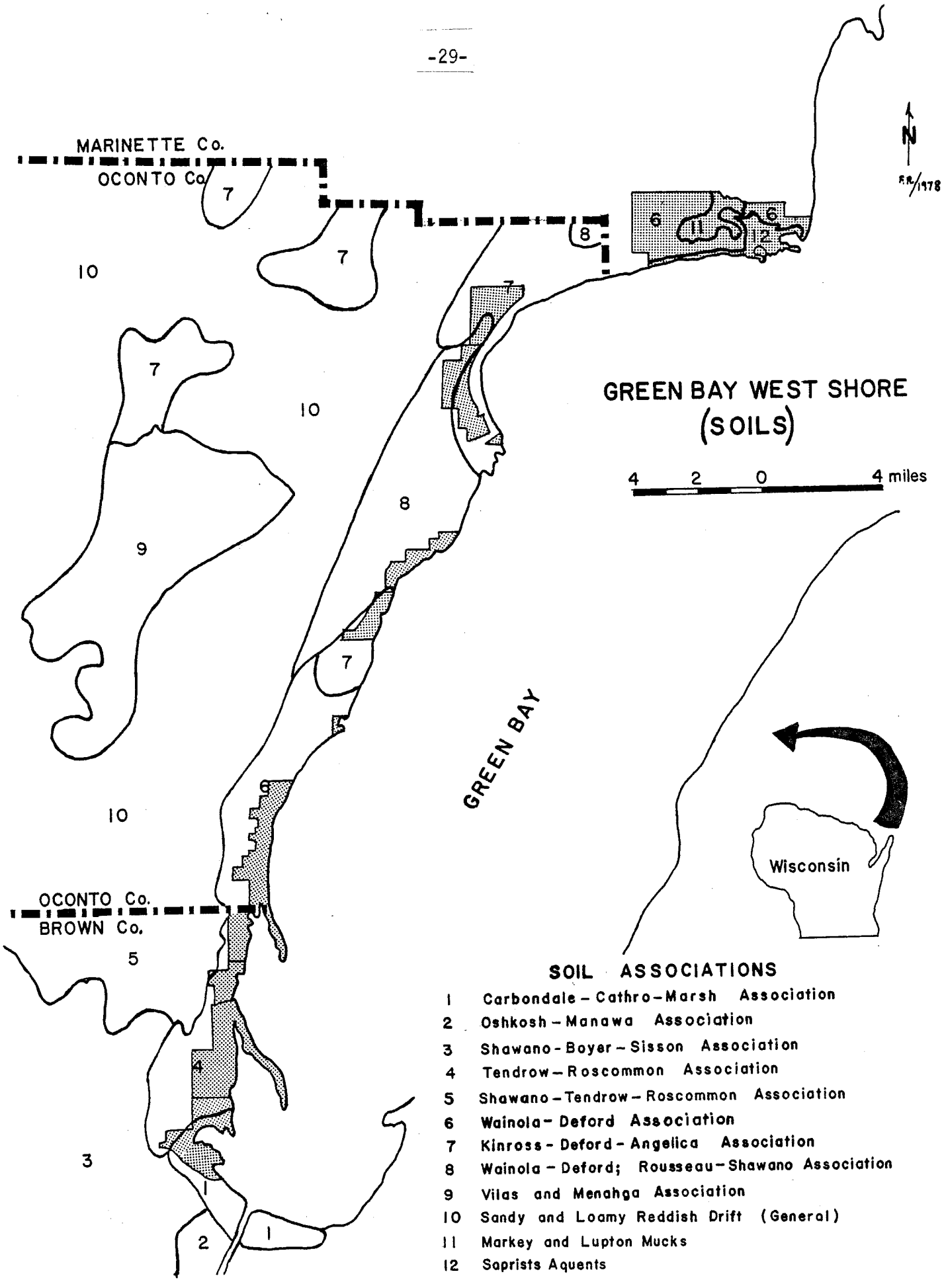
Shoreline Zone or Shore Zone - Region of land composed of littoral area and adjacent shoreland.

Swamp - A wetland composed of primarily woody vegetation.

Wetland - Wet areas where the soil is waterlogged to covered by shallow standing water.

Appendix A

(Vegetation types, SH, BH, CT, LB, LBA, LBW, KG, KH, and KEV, are characteristic of Type I-IV wetlands) (Shaw and Fredine, 1956).


MARINETTE Co.
OCONTO Co.
N
F.R./1978
GREEN BAY WEST SHORE
(SOILS)
4 2 0 4 miles
GREEN BAY
Wisconsin
OCONTO Co.
BROWN Co.
SOIL ASSOCIATIONS
1 Carbondale – Cathro – Marsh Association
2 Oshkosh – Manawa Association
3 Shawano – Boyer – Sisson Association
4 Tendrow – Roscommon Association
5 Shawano – Tendrow – Roscommon Association
6 Wainola – Deford Association
7 Kinross – Deford – Angelica Association
8 Wainola – Deford; Rousseau – Shawano Association
9 Vilas and Menahga Association
10 Sandy and Loamy Reddish Drift (General)
11 Markey and Lupton Mucks
12 Saprists Aquents

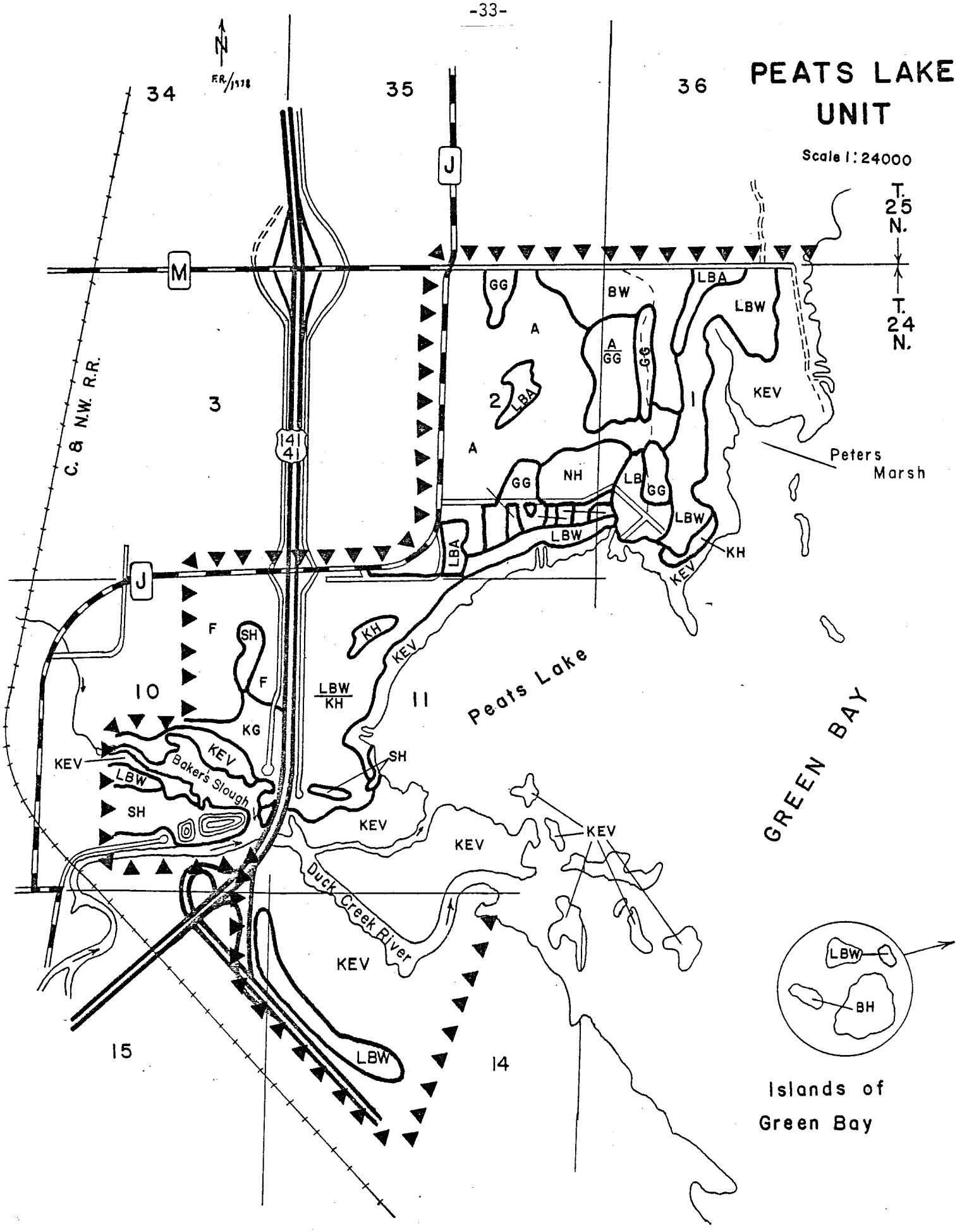
Vegetation Cover Type Classification

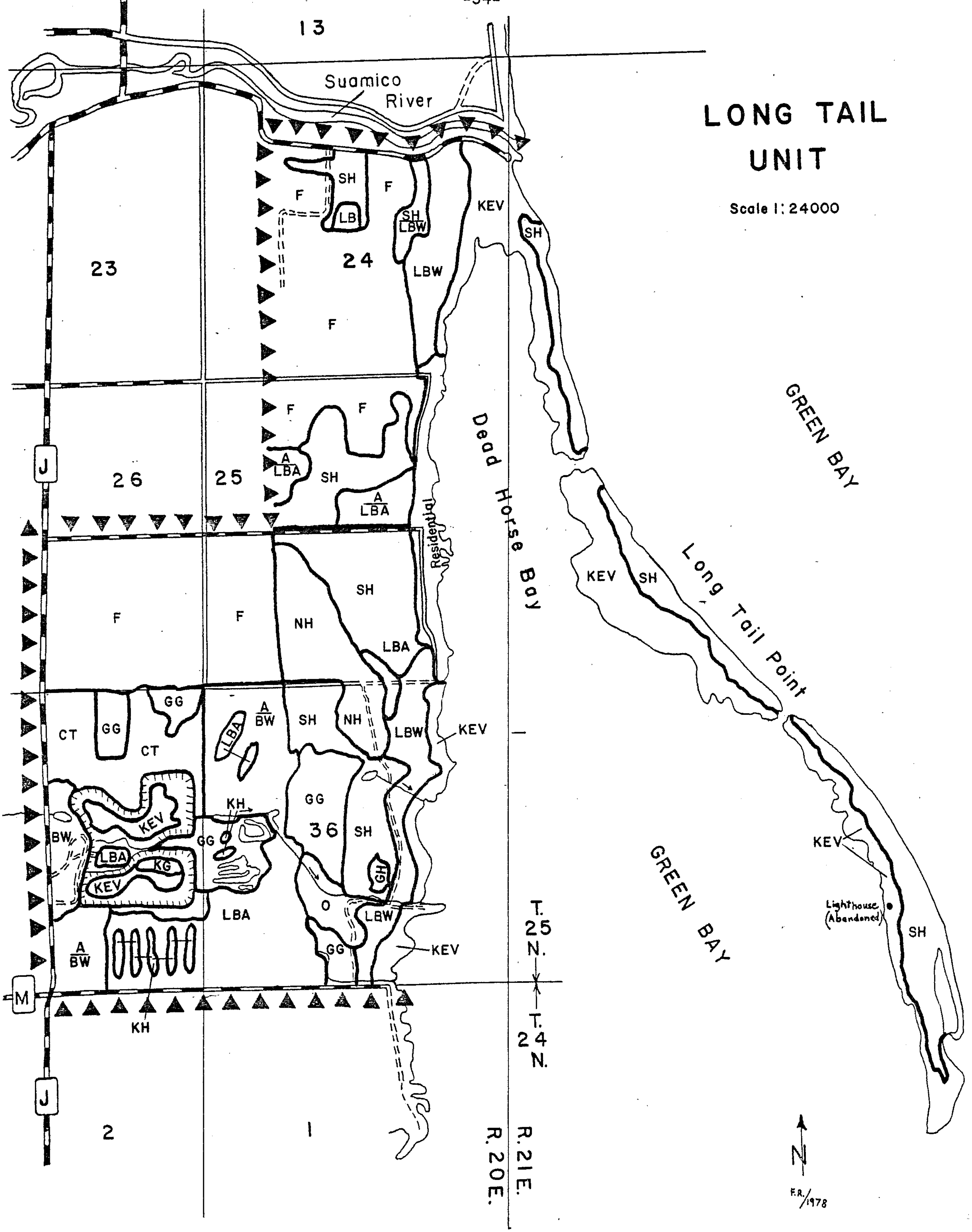
Type	Symbol	Definition
White Pine	PW	More than 50% white pine.
Red Pine	PR	More than 50% red pine.
Tamarack	T	More than 50% tamarack.
Northern Hardwoods	NH	Species: sugar maple, basswood, yellow birch and elm, etc.
Oak	O	Species: red oak, white oak, black oak and associated hardwoods.
Scrub Oak	OX	Various species of oak which are small and will produce only fuelwood and cellulose materials.
Swamp Hardwoods	SH	Species: black ash, American elm, black willow with some cottonwood.
Bottomland Hardwoods	BH	Species: silver maple, cotton wood elm and some aspen.
Aspen	A	More than 50% aspen.
White Birch	BW	More than 50% white birch.
Cottonwood	CT	More than 50% cottonwood.
Grass	G or GG	Predominately true grass species, brome, quack, timothy, little blue stem, Indian grass, etc.
Herbaceous Vegetation	GH	Predominately herbaceous vegetation species, ferns, clover, goldenrod, ragweed, dock, aster, etc.
Upland Brush	RB	Species: hazel, dogwood, sumac, ninebark, etc.
Lowland Brush	LB	Mixed species: alder, willow, red-osier dogwood and small aspen.
Lowland Brush Alder	LBA	More than 50% alder.
Lowland Brush Willow	LBW	More than 50% willow.
Farmland	F	Active agricultural land.
Grazed Farmland	FG	Grazed pastures with fences.

Noncommercial Lowland Grass	KG	Species: canary grass, blue-joint, cordgrass, big blue-stem and carex sp.
Noncommercial Herbaceous Vegetation	KH	Species: lowland asters, nettle, bidens, jewelweed, etc.
Emergent Vegetation	KEV	Species: cattail, bulrush, tall sedges.

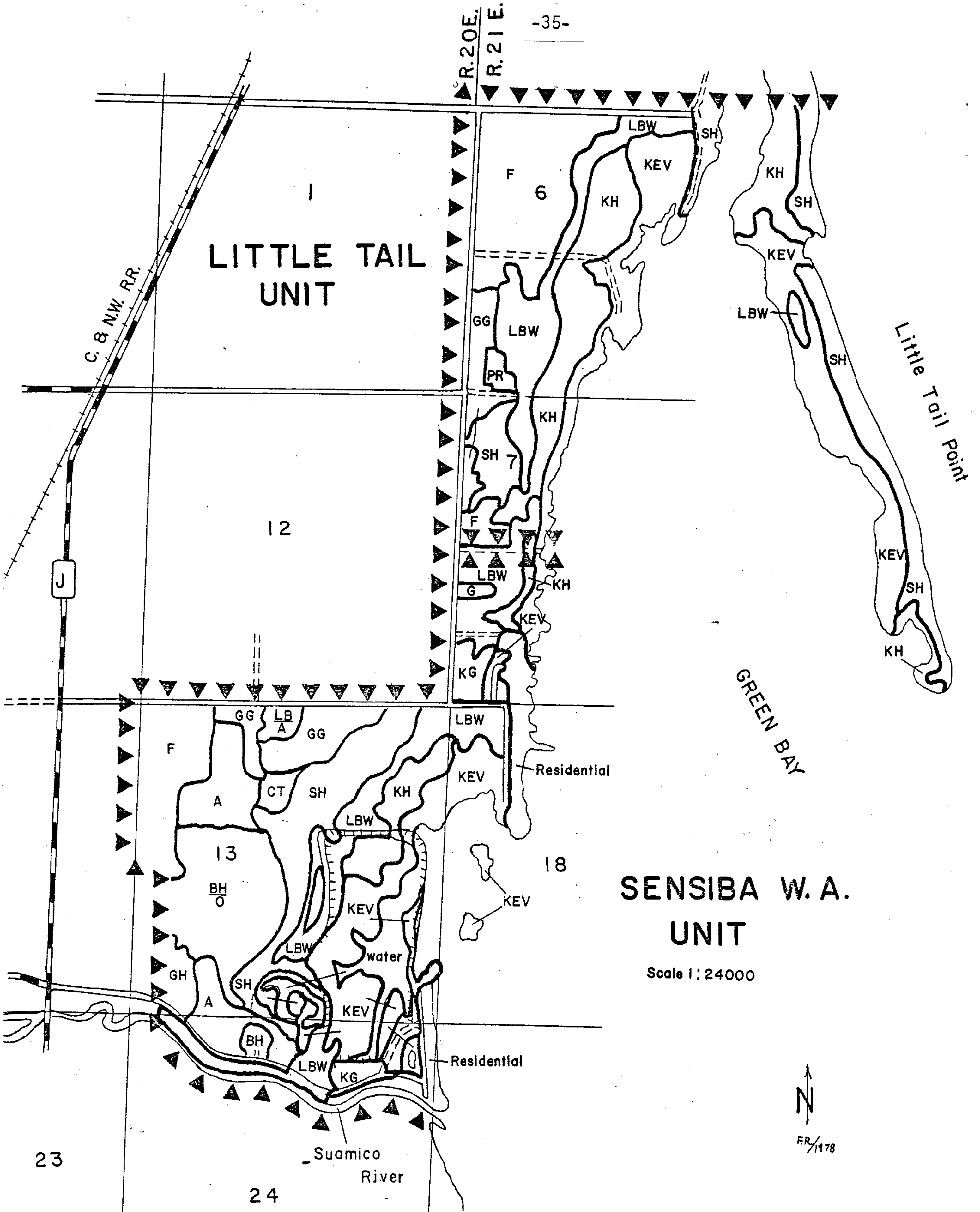
Table 1. Unit Vegetation Types and Acreage Planimetered from Aerial Photographs.

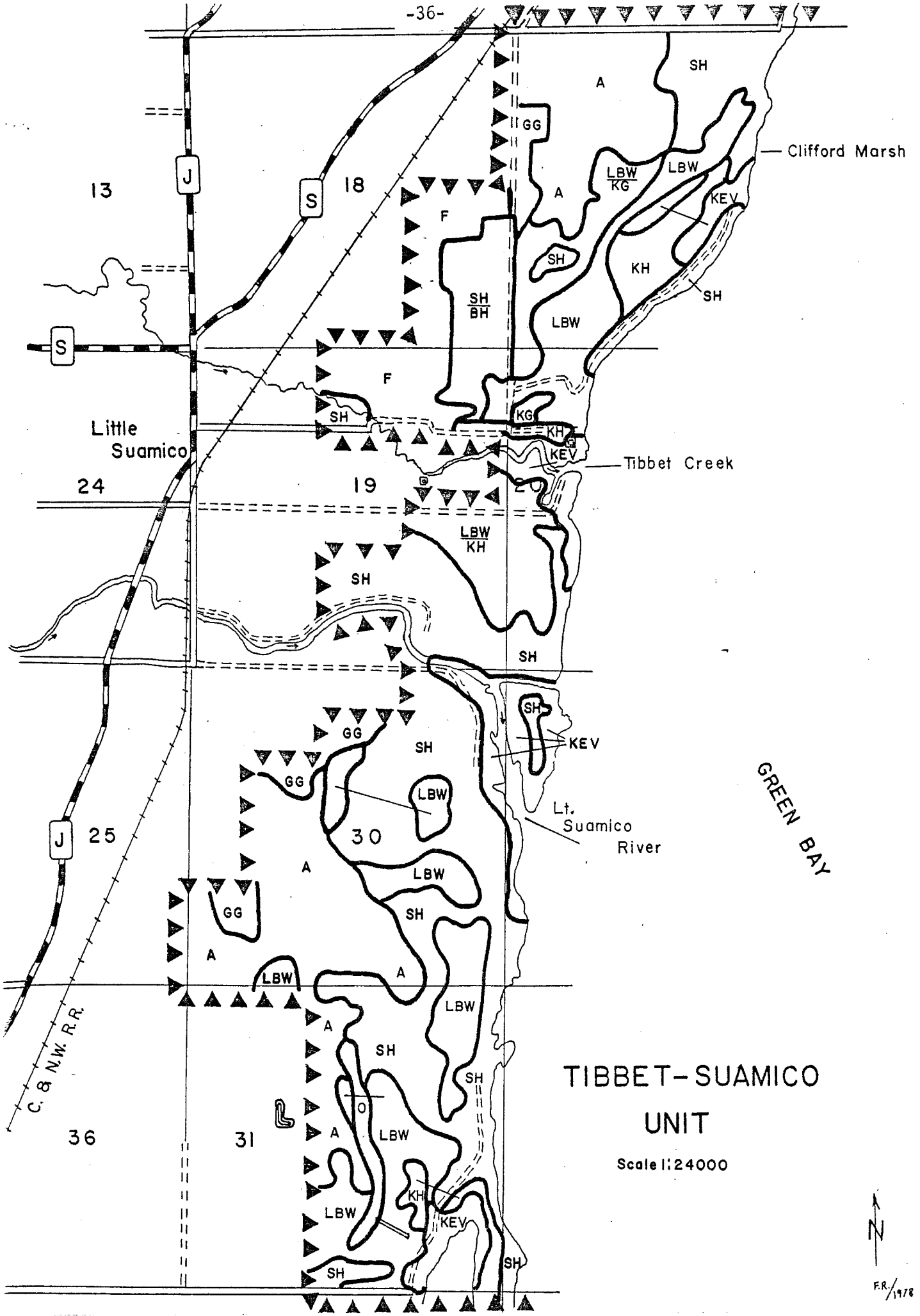
	Vegetation Types						Remaining 16	
Unit	KEV	LBW	SH	A	G	F	Types	Total
Peats Lake	246	228	31	283	80	63	63	994
Long Tail	193	111	337	205	125	418	236	1625
Sensiba	105	93	242	98	50	62	31	681
Little Tail	124	67	130	-	15	62	94	492
Tibbett-Suamico	157	349	538	397	40	55	88	1624
Charles Pond	41	-	43	-	-	-	-	84
Pensaukee	48	186	150	40	25	-	29	478
Pecor Point	44	248	137	27	38	66	75	635
Oconto Marsh	89	319	314	311	-	18	169	1220
Rush Point	32	182	251	359	-	31	174	1029
Peshtigo Harbor	176	2026	531	799	217	-	234	3983
Total	1255	3809	2704	2519	590	775	1193	12,845


PEATS LAKE UNIT
Scale 1:24000
N
F.R./1978
34
35
36
T. 25 N.
T. 24 N.
M
J
C. & N.W. R.R.
3
141
GG
BW
LBA
LBW
A
A/GG
2
1
KEV
Peters Marsh
NH
KH
F
SH
10
11
LBW/KH
Peats Lake
KG
Baker's Slough
GREEN BAY
Duck Creek River
15
14
BH
Islands of Green Bay



LONG TAIL UNIT
Scale 1: 24000
Suamico River
13
23
24
26
25
36
2
1
SH
F
LB
SH/LBW
KEV
LBW
A/LBA
NH
LBA
GG
CT
A/BW
BW
KEV
LBA
KG
KH
O
GH
Residential
Dead Horse Bay
GREEN BAY
Long Tail Point
Lighthouse (Abandoned)
J
M
T. 25 N.
T. 24 N.
R. 20 E.
R. 21 E.
N
F.R./1978


R.20E.
R.21E.
LITTLE TAIL
UNIT
C. & N.W. R.R.
J
1
6
12
7
13
18
23
24
F
LBW
KEV
SH
KH
GG
PR
G
KG
LB
A
CT
BH
O
GH
water
Residential
Little Tail Point
GREEN BAY
Suamico
River
SENSIBA W. A.
UNIT
Scale 1: 24000
N
F.R./1978

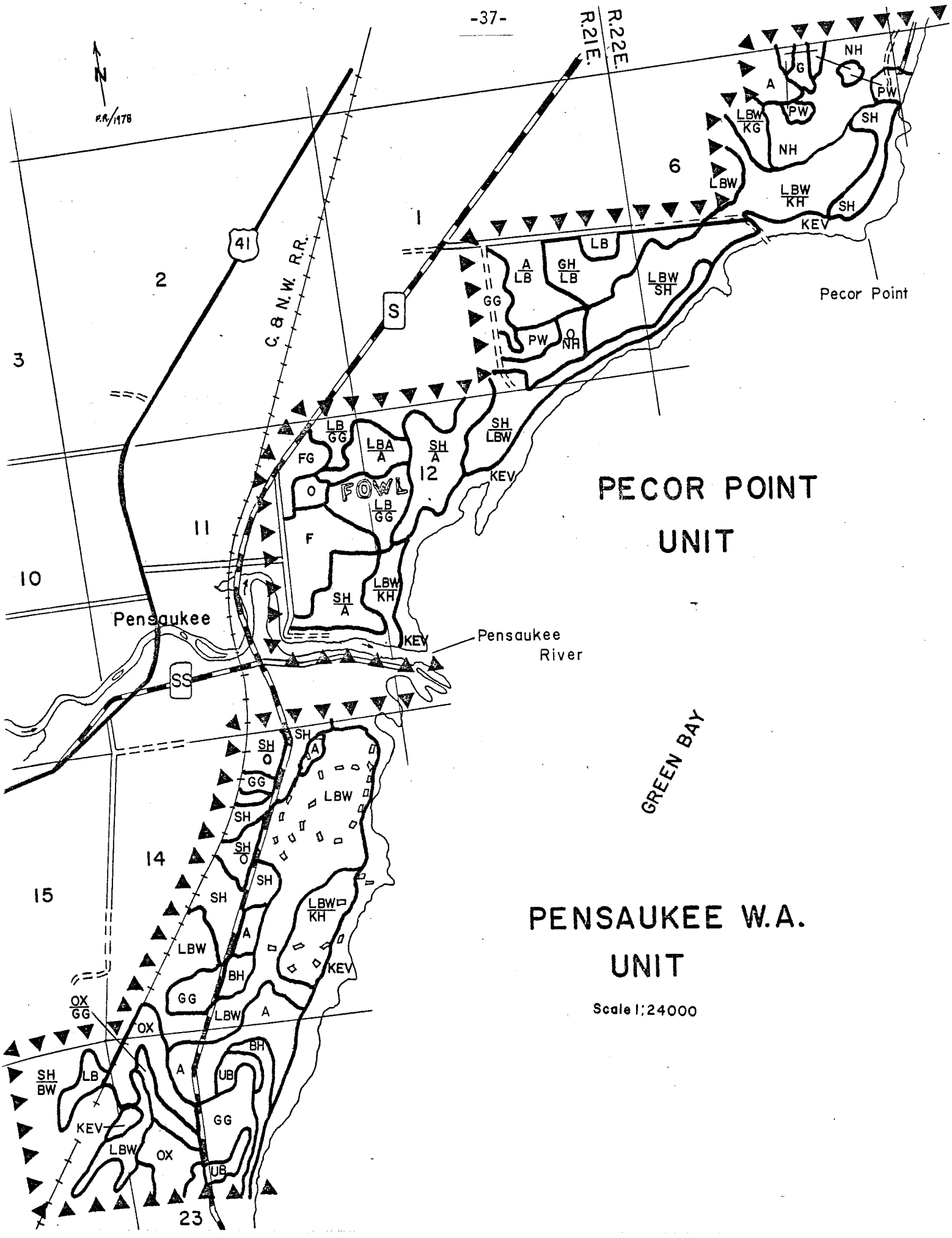


TIBBET-SUAMICO UNIT

Scale 1:24000

N

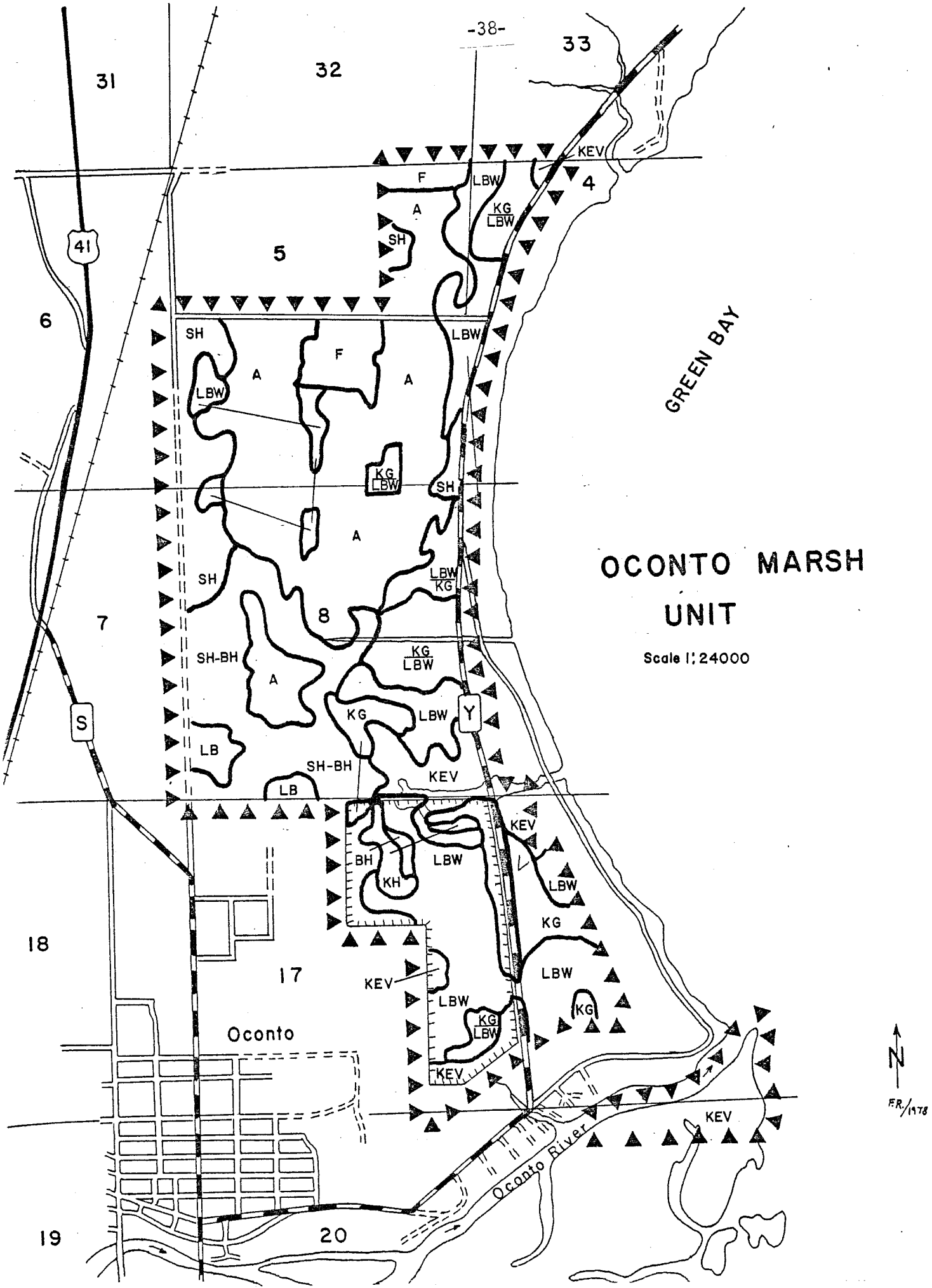
F.R./1978



PECOR POINT UNIT

PENSAUKEE W.A. UNIT

Scale 1:24000


31
32
33
4
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6
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8
17
18
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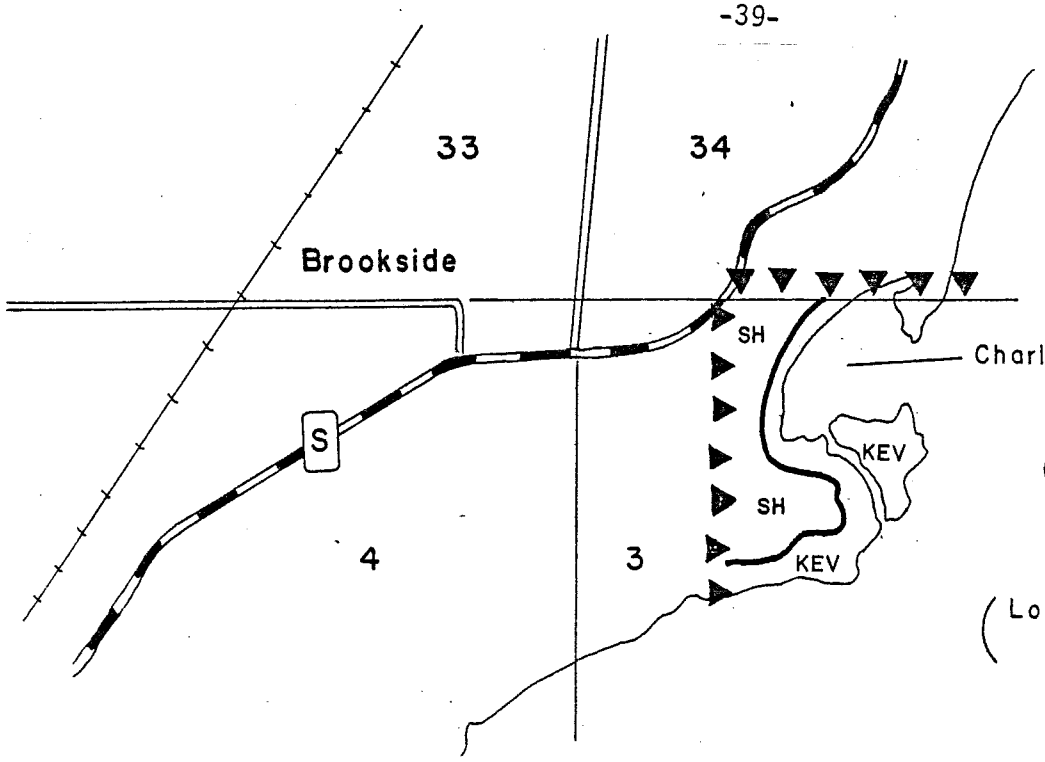
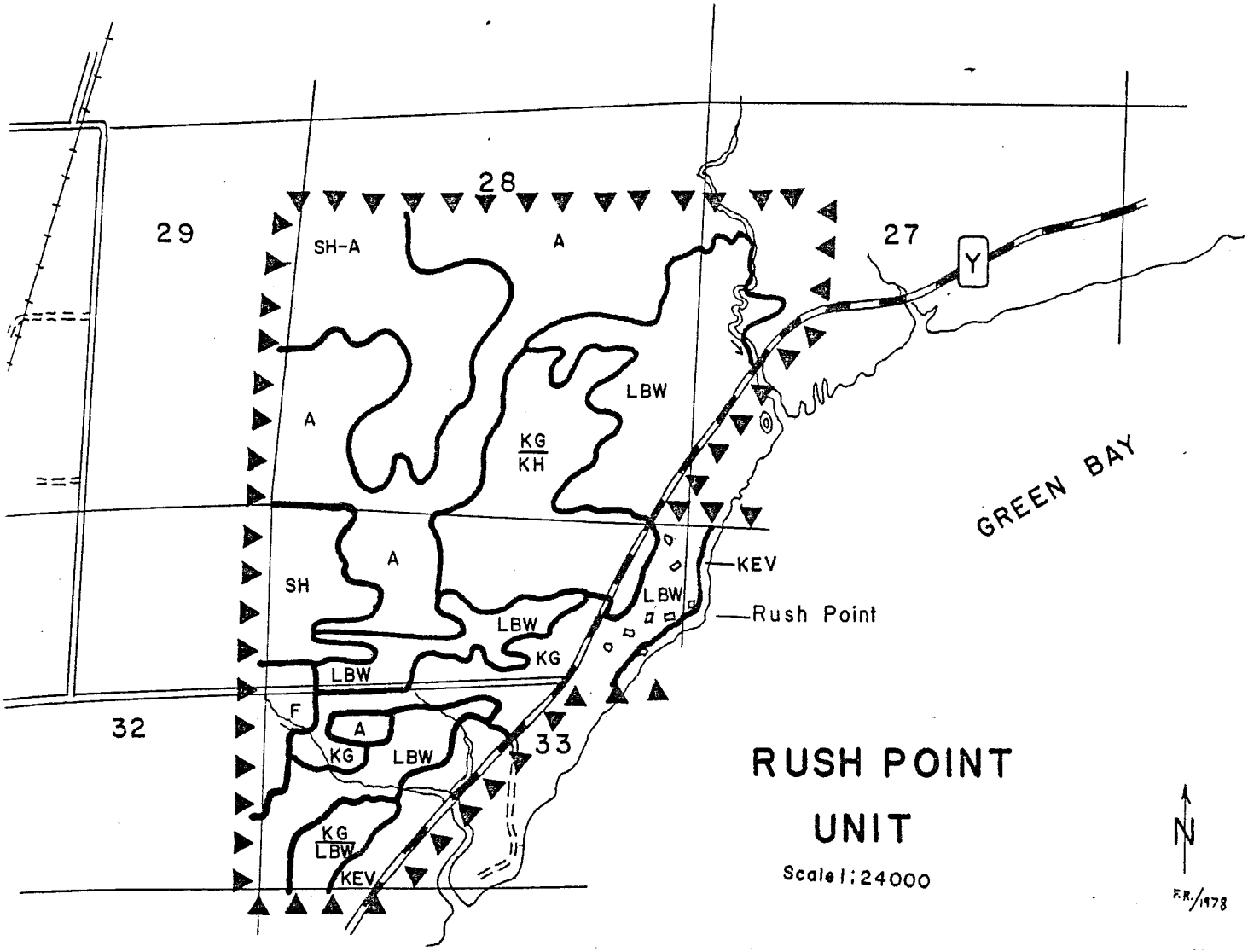
20
41
S
Y
KEV
F
A
LBW
KG
LBW
SH
SH-BH
LB
BH
KH
GREEN BAY
Oconto
Oconto River
OCONTO MARSH
UNIT
Scale 1:24000
N
F.R./1978



CHARLES POND UNIT

(Located 1.5 mi. north of Tibbet-Suamico Unit)

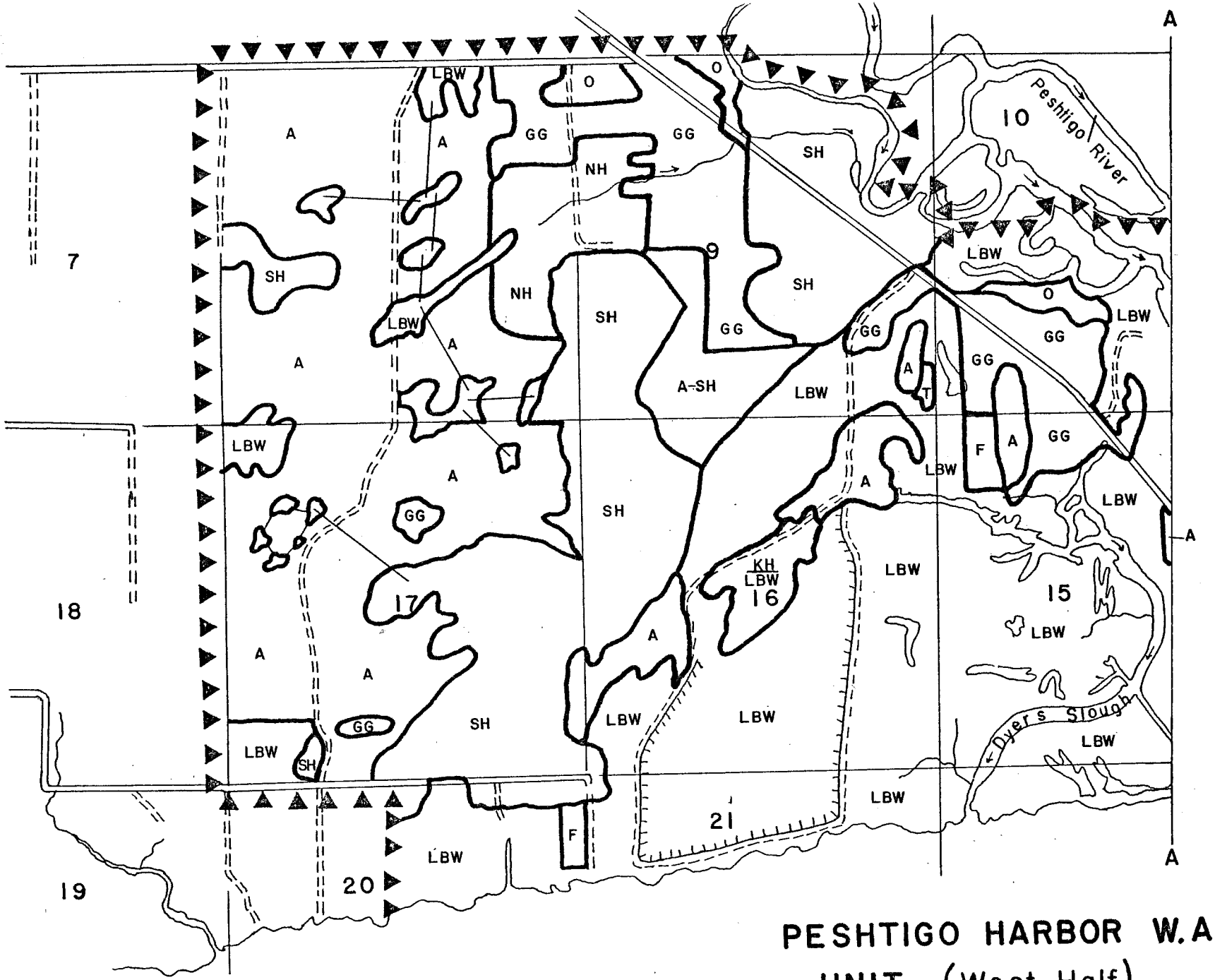


RUSH POINT UNIT

Scale 1:24000

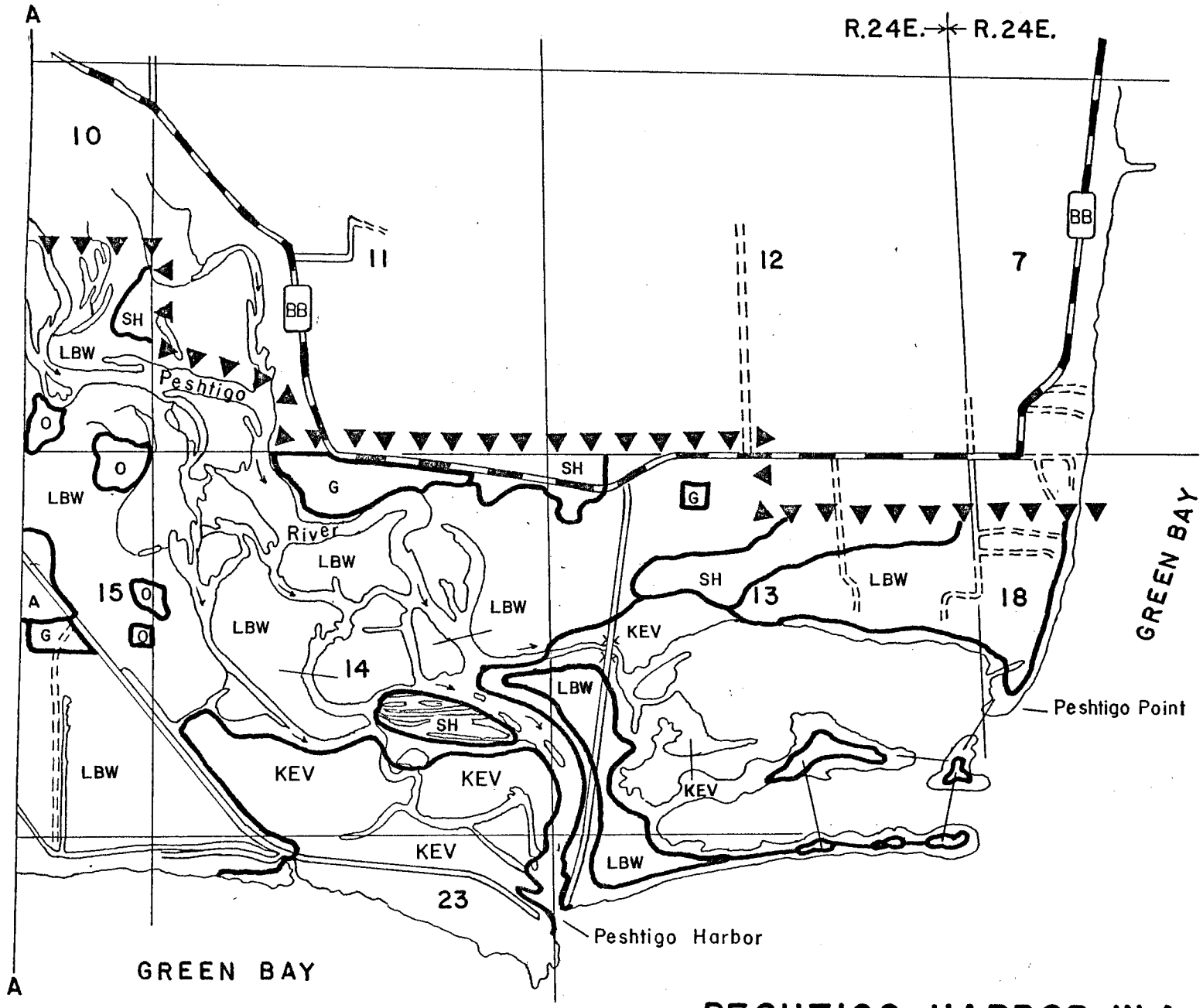
N

F.R./1978



PESHTIGO HARBOR W.A
UNIT (West Half)

Scale 1:24000



PESHTIGO HARBOR W.A.
UNIT (East Half)

Scale 1:24000

Appendix B

Table 2. Green Bay West Shore Project Ownership and Priority I Parcels, Dwellings, Acreage and Cost.

Unit	Private Ownership Acreage	Priority I Land Parcel	With Dwellings	Acreage	Cost	County Land Acreage	State Land Acreage	Total Acreage Goal
Peats Lake	754	10	3	714	$452,000	447	0	1201
Long Tail	1219	13	5	1212	$688,000	473	107	1799
Sensiba	372	11	5	362	$187,000	0	450	822
Little Tail	523	12	11	516	$241,000	0	56	579
Tibbet-Suamico	1571	9	3	1564	$600,000	0	152	1723
Charles Pond	0	0	0	0	0	0	110	110
Pensaukee	113	3	1	113	$ 45,000	0	370	483
Pecor Point	554	8	1	547	$172,000	0	0	554
Oconto Marsh	669	9	2	664	$186,000	0	560	1229
Rush Point	883	5	2	878	$250,000	120	40	1043
Peshtigo Harbor	1026	14	3	1026	$256,000	0	3364	4390
TOTAL	7684	94	36	7596	$3,057,000	1040	5209	13,933

Table 3 - Potential Developments of the West Shore

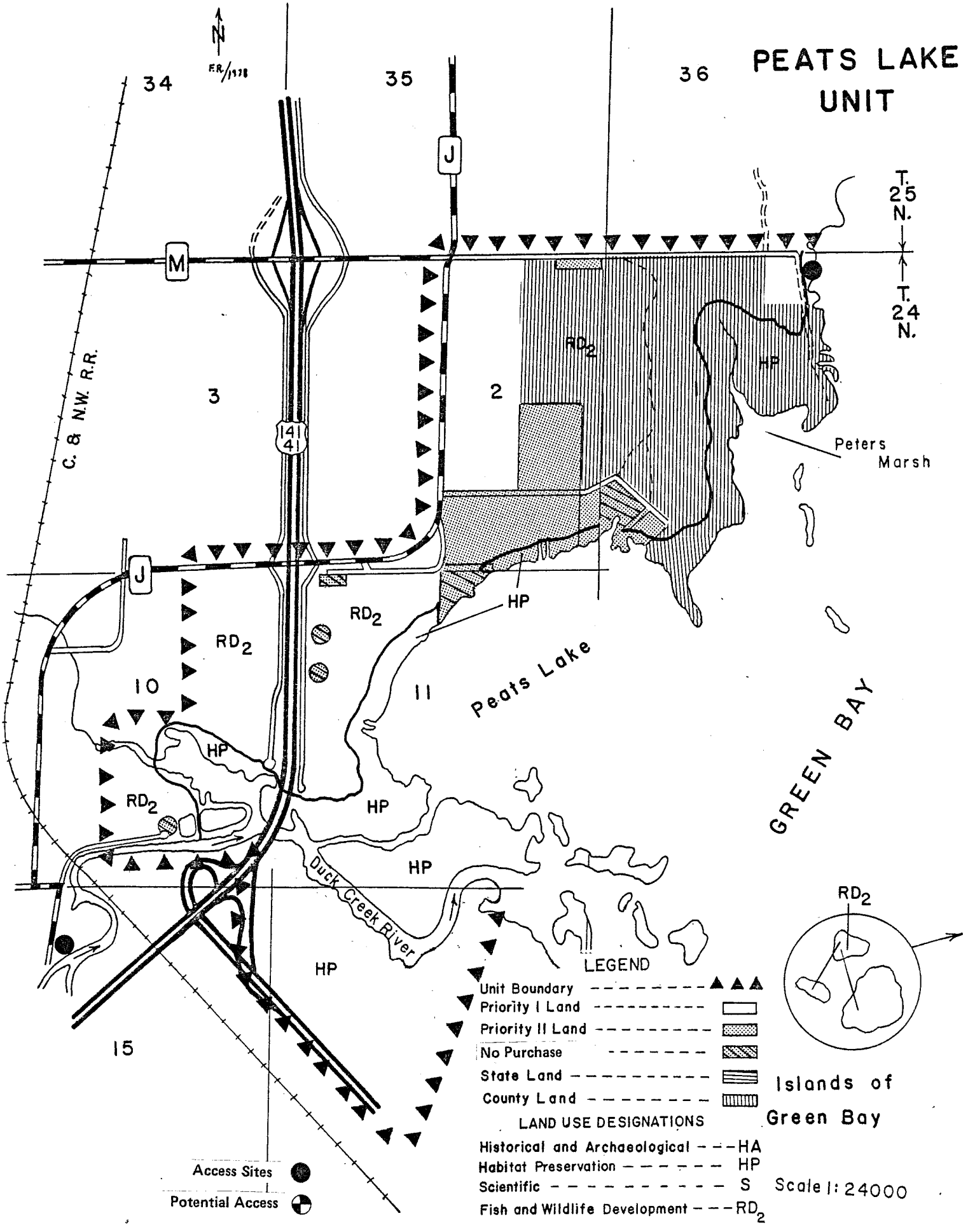
Illustrated in Appendix B*

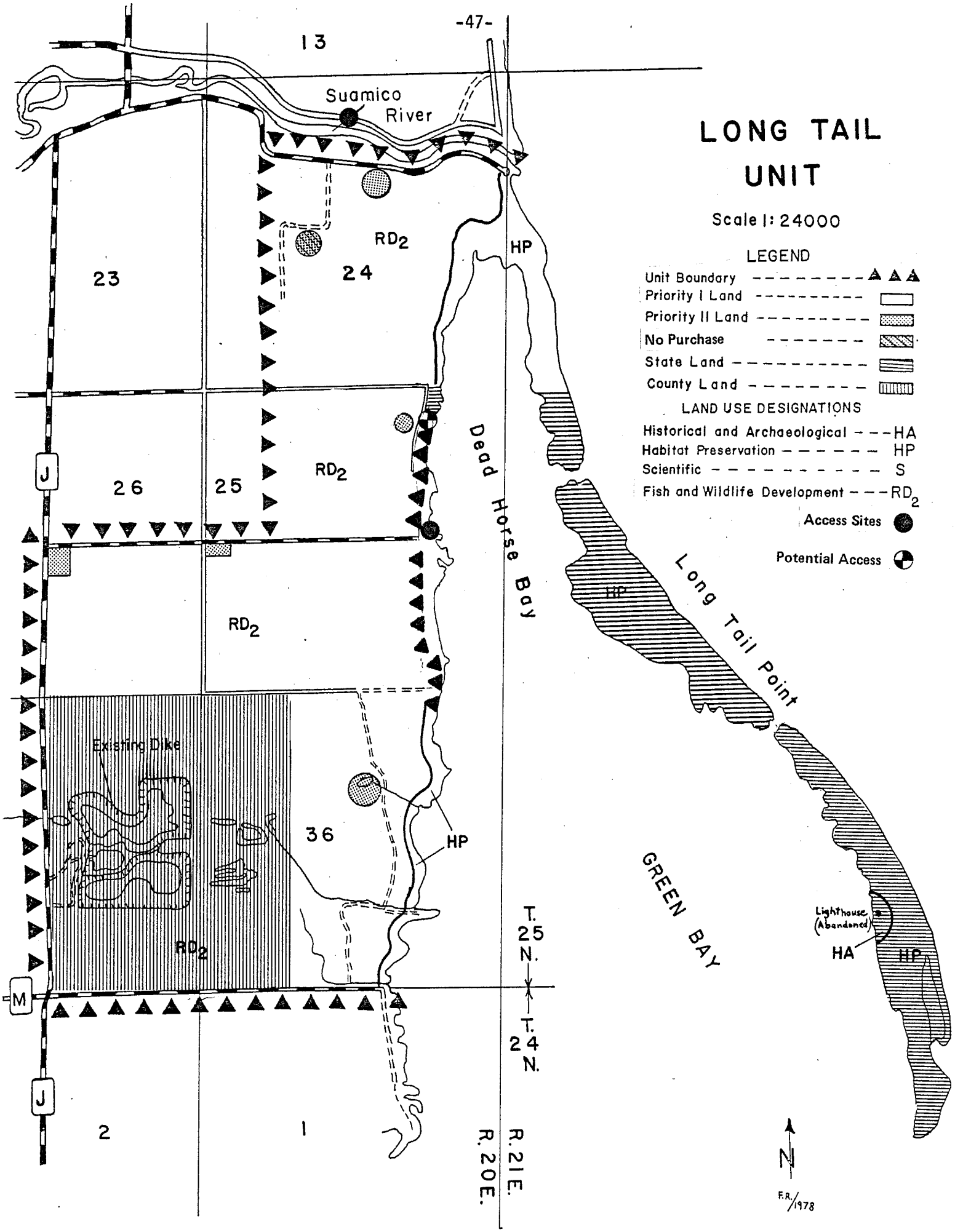
Unit	Development	Effect	Tract*	Cost $
Peats Lake	DNC	30 Acres	Wesley Bookter	$3,000.00
Long Tail	DNC	100 Acres	Malchow Hubbard	$10,000.00
Sensiba	DNC	30 Acres	Hanson Hussong	$3,000.00
Little Tail	DNC Runoff Pond	30 Acres 60' x 170' x 3' Pond	Payne & VanderLeest DNR Land	$3,000.00 $600.00
Tibbet-Suamico	DNC 1.6 Miles of Dike	20 Acres 100 Acre Impound.	Rost & Stiller Wis. Pub. Ser. Corp.	$2,000.00 $36,000.00
Charles Pond	--	--	--	--
Pensaukee	1 Mile of Dike	60 Acre Impound.	DNR Land	$23,000.00
Pecor Point	DNC 1.8 Miles Dike	30 Acres 110 Acre Impound.	Dittman Forgie & Heise	$3,000.00 $38,000.00
Oconto Marsh	DNC 1.5 Mile Dike	15 Acres 100 Acre Impound.	Seidl Mar Von Corp.	$1,500.00 $32,000.00
Rush Point	DNC 2 Mile Dike	15 Acres 160 Acre Impound.	Lindgren Lindgren	$1,500.00 $46,000.00
Peshtigo Harbor	Retain. Dam & 1.5 Mi. Dike	200 Acre Impound.	Porter & Surk	$40,000.00
TOTAL	--	--	--	$242,600.00

Table 4 Historical and Archeological Sites - Green Bay West Shore Wildlife Area

Unit	Type	Location
Peats Lake	Campsite	Section 11 T24N, R20E
	Campsite	Section 15 T24N, R20E
	Campsite	Section 1 T24N, R20E
Long Tail	Stone Lighthouse	Section 32 T25N, R21E
	Campsite	Section 30 T25N, R21E
	Mound	Section 25 T25N, R20E
	Indian Burial Ground	Sections 24 and 25 T25N, R20E
	Bender II Village Site	Section 24 T25N, R20E
	Indian Village Site & Cemetary	Sections 23 and 25 T25N, R20E
	Bender I Village Site	Section 24 T25N, R20E
	Trading Post	Section 24 T25N, R20E
Sensiba	Two Cemetaries	Section 24 T25N, R20E
	Campsite and Workshop	Section 12 T25N, R20E
Tibbet-Suamico	Mounds	Section 20 T26N, R21E
	Campsite	Section 20 T26N, R21E
	Indian Campground	Section 19 T26N, R21E
	Mounds	Section 19 T26N, R21E
	Cemetary	Section 19 T26N, R21E
	Campsite	Section 19 T26N, R21E
	Cemetary	Section 19 T26N, R21E
	Campsite	Section 19 and 20 T26N, R21E
	Garden Beds and Cornhills	Section 19 and 20 T26N, R21E
Pensaukee	Harbor Light	Section 12 T27N, R21E
Pecor Point	Historic Menominee Campsite	Section 12 T27N, R21E
Oconto Marsh	Village and Cemetary	Section 21 T28N, R21E
Peshito Harbor	Slough Bridge	Section 13 T29N, R23E
	Village and Cemetary	Section 14 T29N, R23E
	Campsite and Cemetary	Section 11 T29N, R23E

Total: 28 sites


PEATS LAKE UNIT
N
E.R./1978
34
35
36
T. 25 N.
T. 24 N.
M
J
141
C. & N.W. R.R.
3
2
RD2
HP
Peters Marsh
10
11
Peats Lake
GREEN BAY
Duck Creek River
15
LEGEND
Unit Boundary
Priority I Land
Priority II Land
No Purchase
State Land
County Land
LAND USE DESIGNATIONS
Historical and Archaeological ---HA
Habitat Preservation ------- HP
Scientific ---------- S
Fish and Wildlife Development ---RD2
Access Sites
Potential Access
Islands of Green Bay
Scale 1: 24000



LONG TAIL UNIT

Scale 1: 24000

LEGEND

Unit Boundary

Priority I Land

Priority II Land

No Purchase

State Land

County Land

LAND USE DESIGNATIONS

Historical and Archaeological — HA

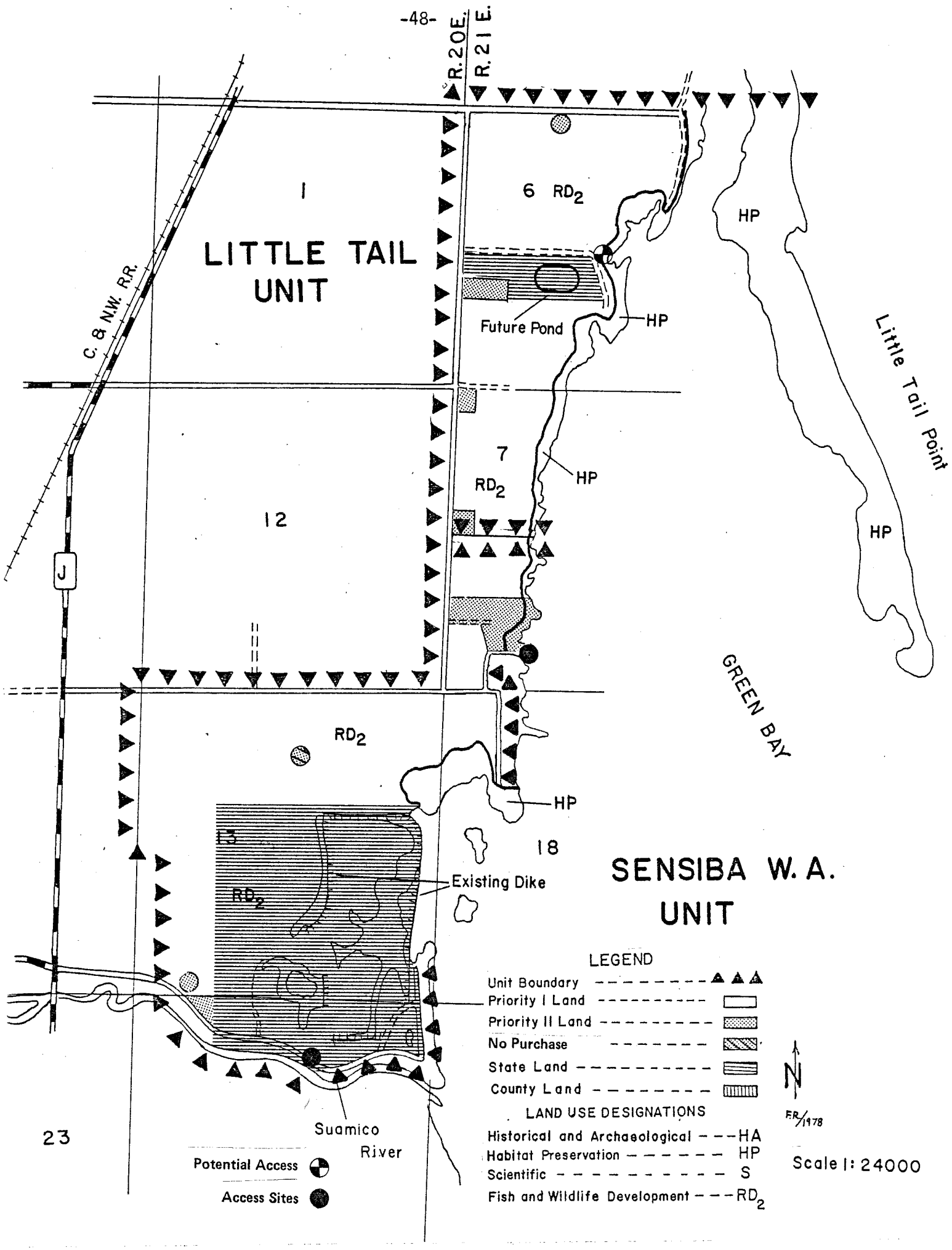
Habitat Preservation — HP

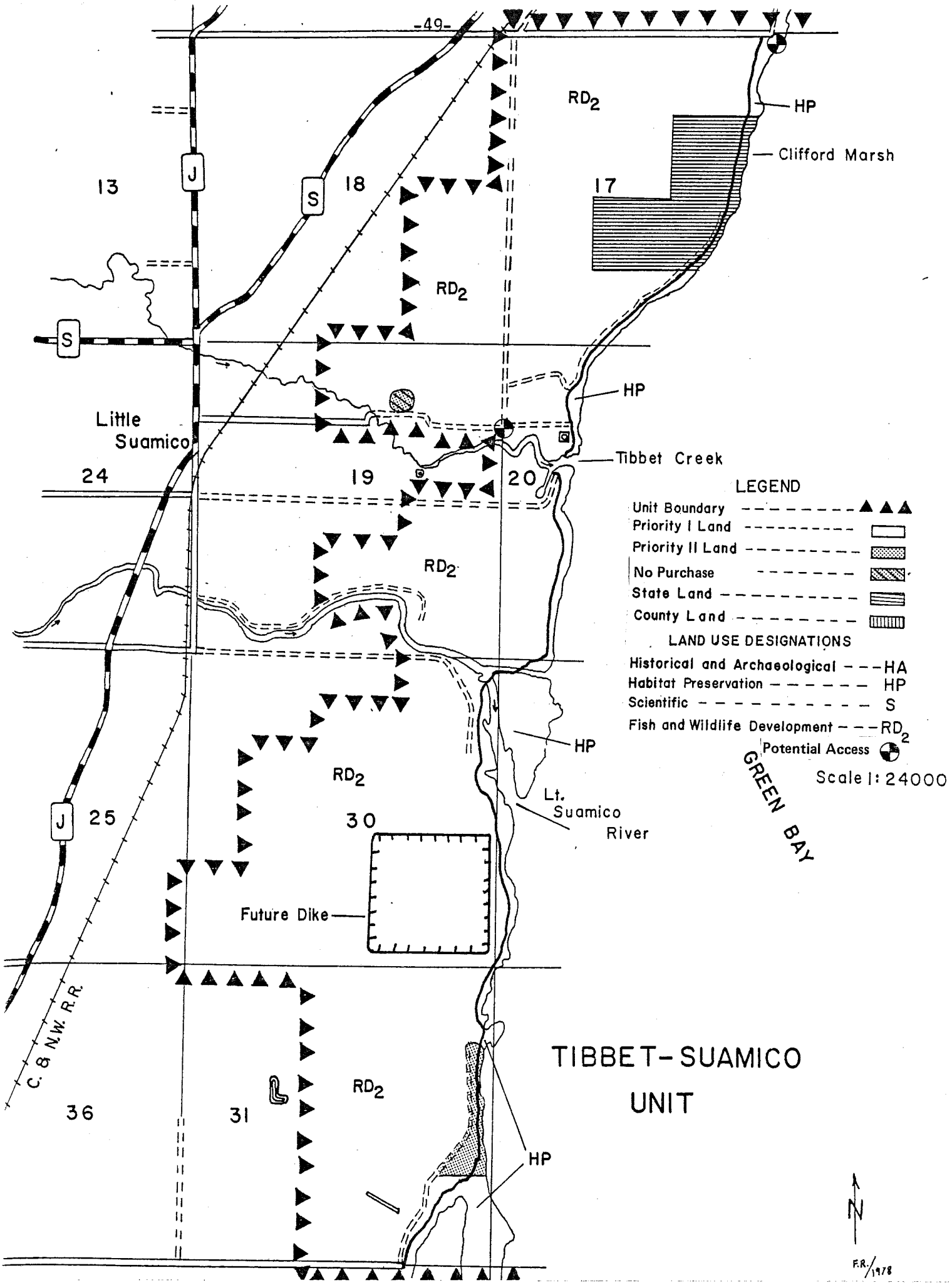
Scientific — S

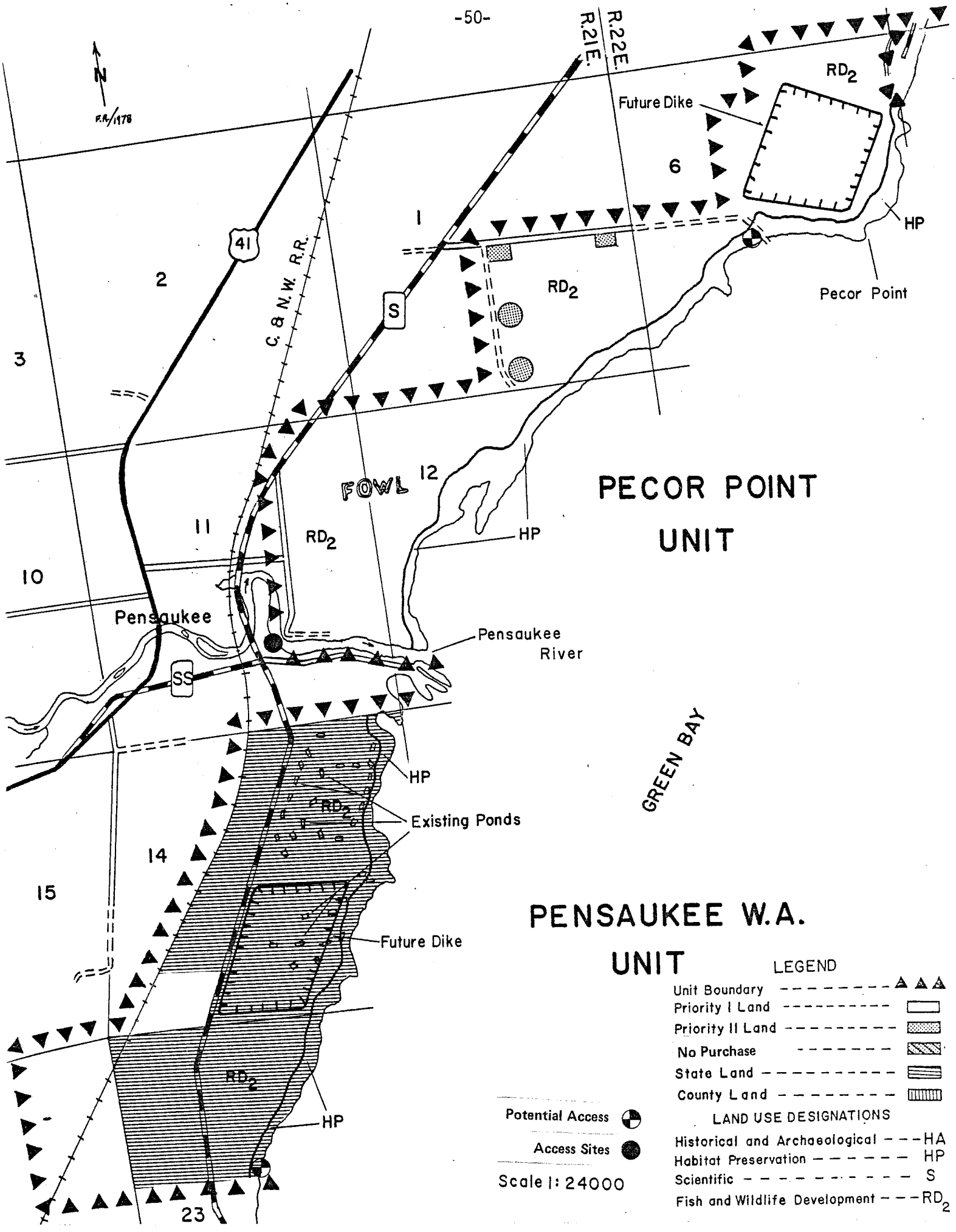
Fish and Wildlife Development — RD_2

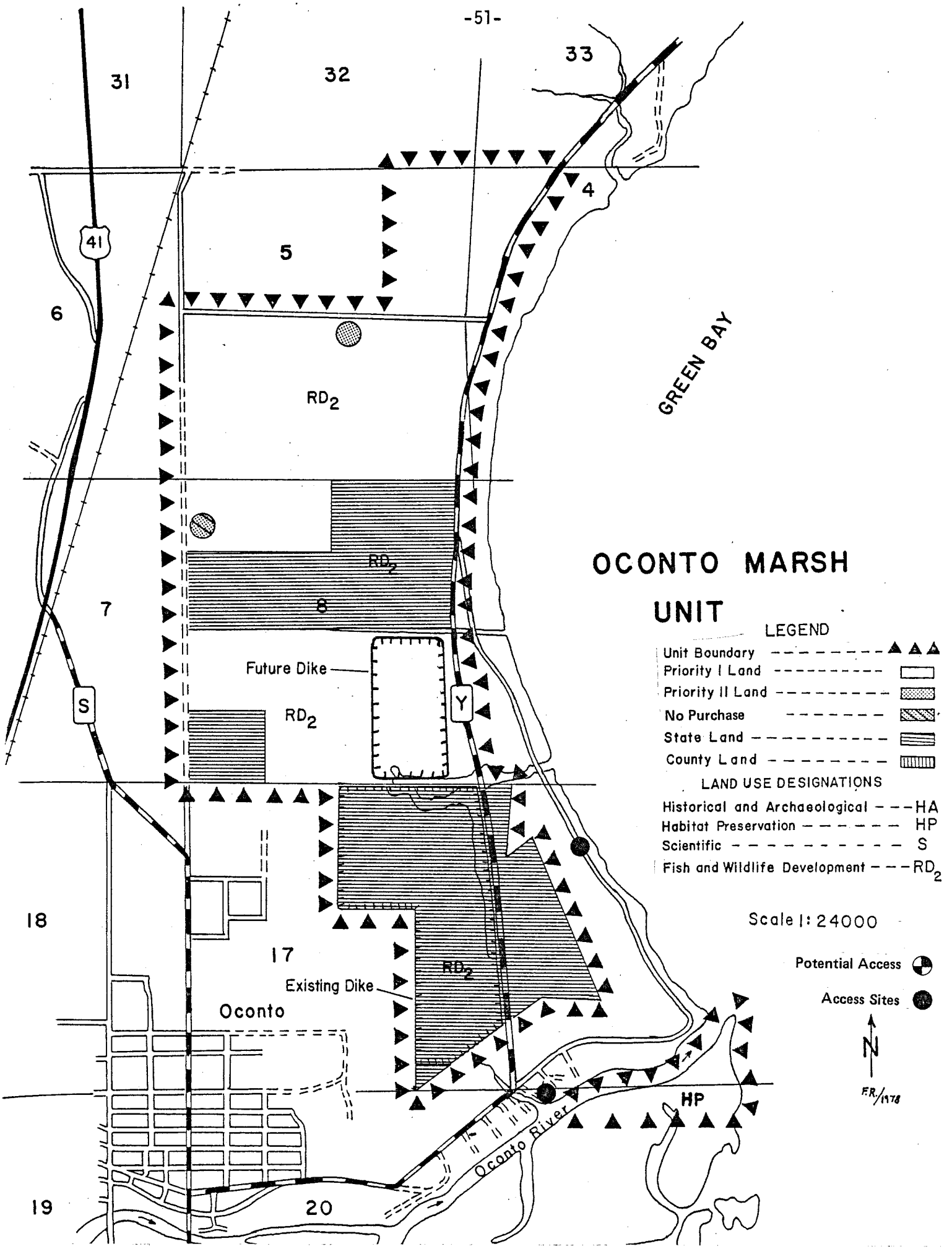
Access Sites

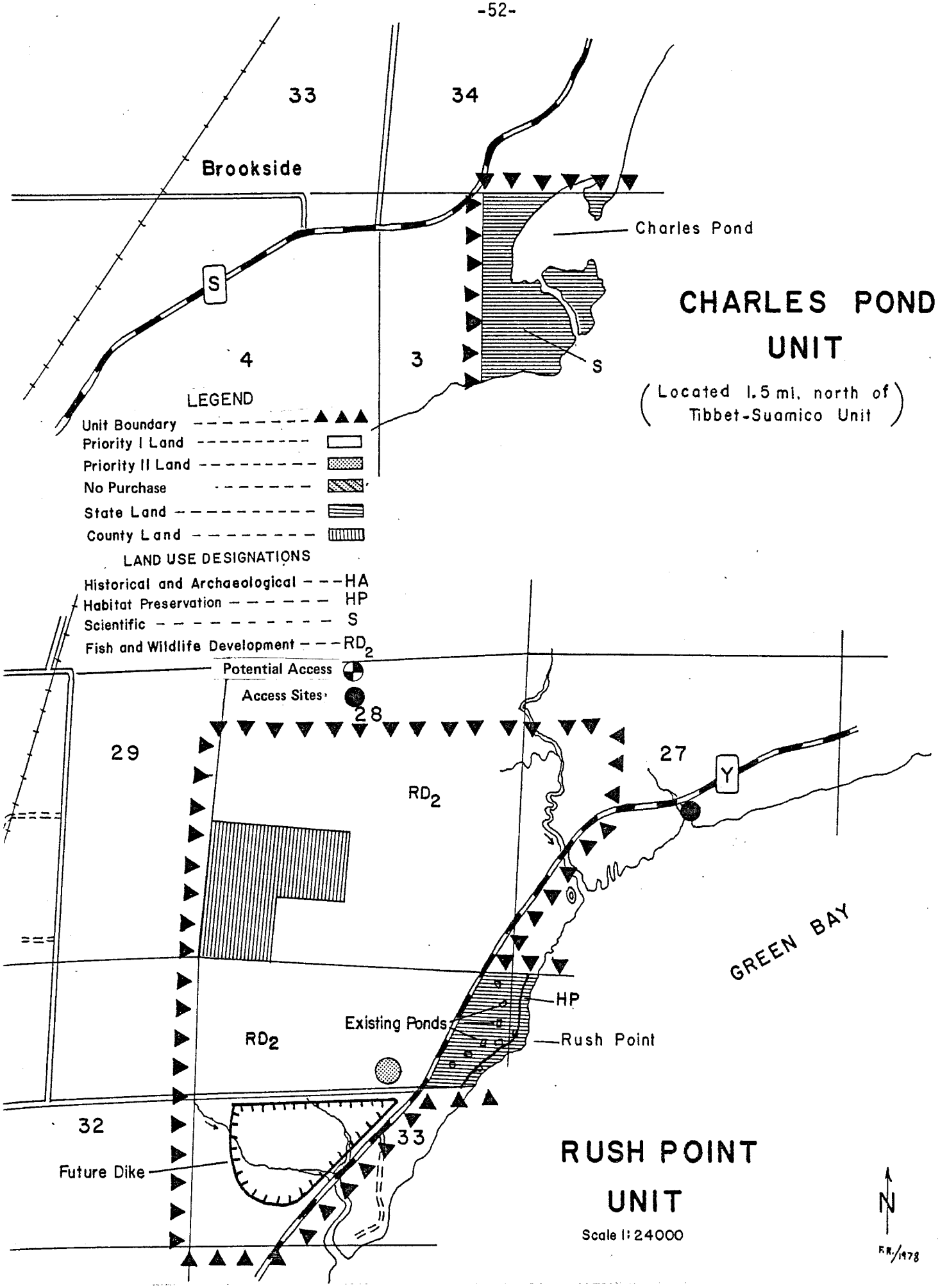
Potential Access


R.20E.
R.21E.
1
LITTLE TAIL UNIT
C. & N.W. R.R.
6 RD2
HP
Future Pond
HP
Little Tail Point
7
RD2
HP
12
J
HP
GREEN BAY
RD2
HP
13
18
RD2
Existing Dike
SENSIBA W. A. UNIT
LEGEND
Unit Boundary
Priority I Land
Priority II Land
No Purchase
State Land
County Land
LAND USE DESIGNATIONS
Historical and Archaeological ---HA
Habitat Preservation ------- HP
Scientific ---------- S
Fish and Wildlife Development ---RD2
N
FR/1978
Scale 1: 24000
Suamico River
Potential Access
Access Sites
23


RD2
HP
Clifford Marsh
13
J
S
18
17
RD2
S
HP
Little
Suamico
Tibbet Creek
24
19
20
RD2
HP
RD2
J
25
30
Lt.
Suamico
River
Future Dike
C. & N.W. R.R.
36
31
RD2
HP
GREEN BAY
LEGEND
Unit Boundary
Priority I Land
Priority II Land
No Purchase
State Land
County Land
LAND USE DESIGNATIONS
Historical and Archaeological HA
Habitat Preservation HP
Scientific S
Fish and Wildlife Development RD2
Potential Access
Scale 1: 24000
TIBBET-SUAMICO
UNIT
N
F.R./1978


R.21E.
R.22E.
N
F.R./1178
41
S
SS
C. & N.W. R.R.
Future Dike
RD2
HP
Pecor Point
FOWL
PECOR POINT UNIT
Pensaukee
Pensaukee River
GREEN BAY
Existing Ponds
PENSAUKEE W.A. UNIT
1
2
3
6
10
11
12
14
15
23
Potential Access
Access Sites
Scale 1: 24000
LEGEND
Unit Boundary
Priority I Land
Priority II Land
No Purchase
State Land
County Land
LAND USE DESIGNATIONS
Historical and Archaeological HA
Habitat Preservation HP
Scientific S
Fish and Wildlife Development RD2


31
32
33
4
5
6
41
RD2
GREEN BAY
RD2
7
8
Future Dike
RD2
S
Y
18
17
RD2
Existing Dike
Oconto
HP
Oconto River
19
20
OCONTO MARSH
UNIT
LEGEND
Unit Boundary
Priority I Land
Priority II Land
No Purchase
State Land
County Land
LAND USE DESIGNATIONS
Historical and Archaeological ---HA
Habitat Preservation ------- HP
Scientific ---------- S
Fish and Wildlife Development ---RD2
Scale 1:24000
Potential Access
Access Sites
N
F.R./1978



CHARLES POND UNIT

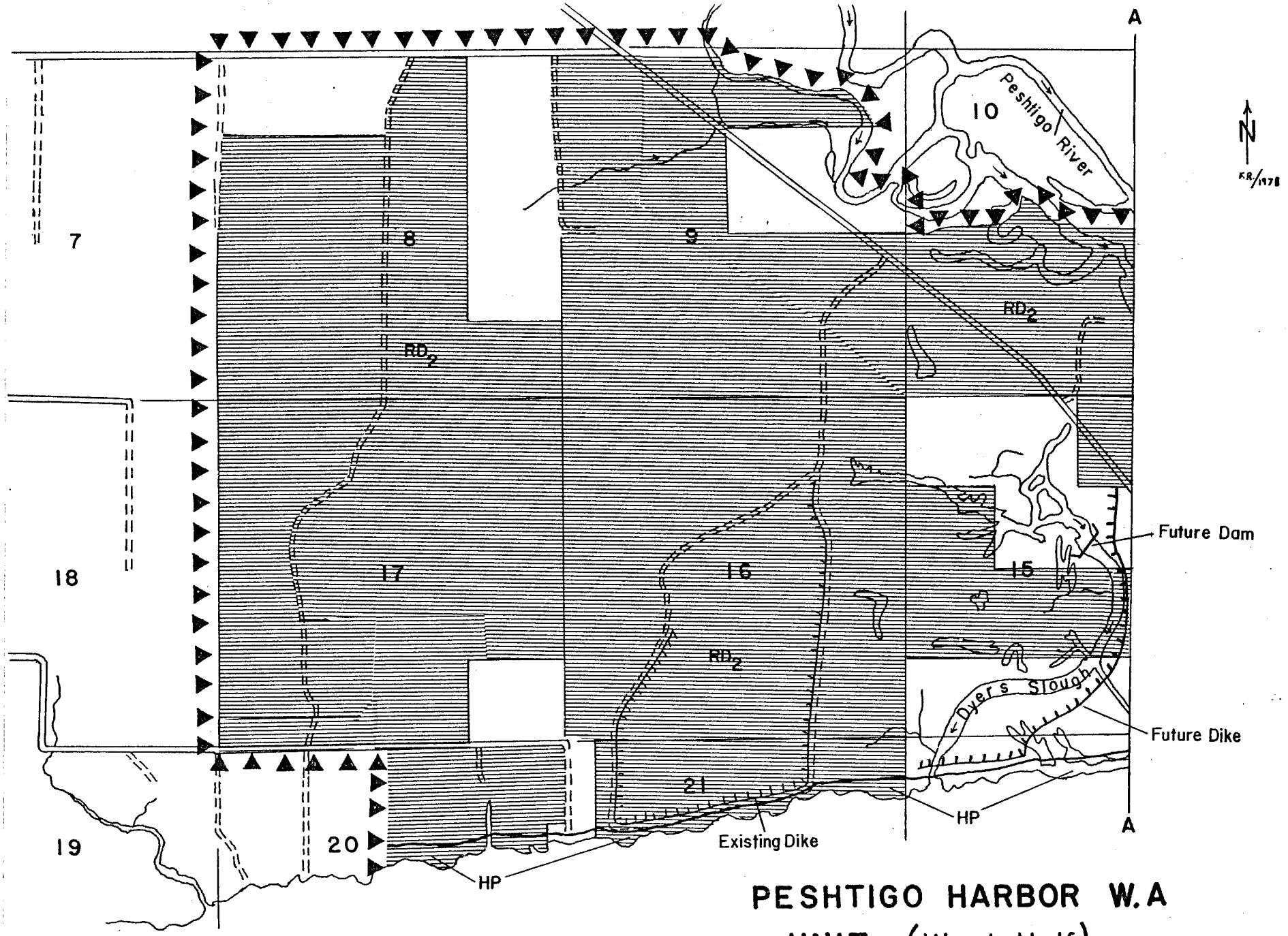
(Located 1.5 mi. north of Tibbet-Suamico Unit)

RUSH POINT UNIT

Scale 1:24000

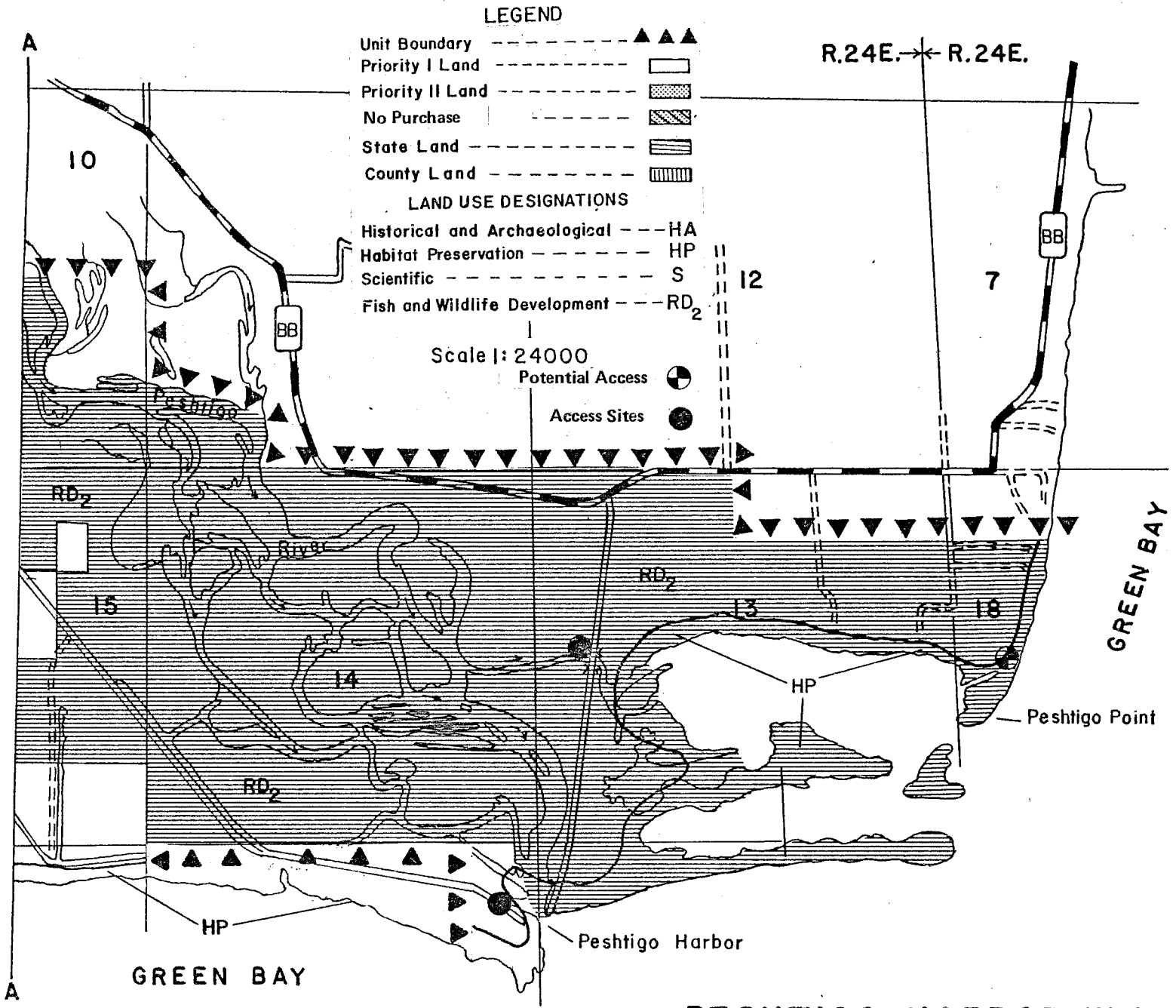
N

F.R./1978



PESHTIGO HARBOR W.A
UNIT (West Half)

Scale 1: 24000



PESHTIGO HARBOR W.A. UNIT (East Half)